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James Long

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The Best Swede.

CARTERS' NEW ELEPHANT.

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That best meet a Deficiency of Stock Food.

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Quantity per Acre.		*For Consumption*
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10 lbs.	of **Rape**	Next Spring or ploughing in.
20 lbs,	of [illegible]	ghing in.
5 lbs,		mmer.
4 bushe		
30 lbs.		
30 lbs.		
30 lbs.		
3 bushe		
5 lbs.		
6 lbs.		
6 lbs.		
4 bushe		

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Royal Seedsmen by Sealed Warrants.

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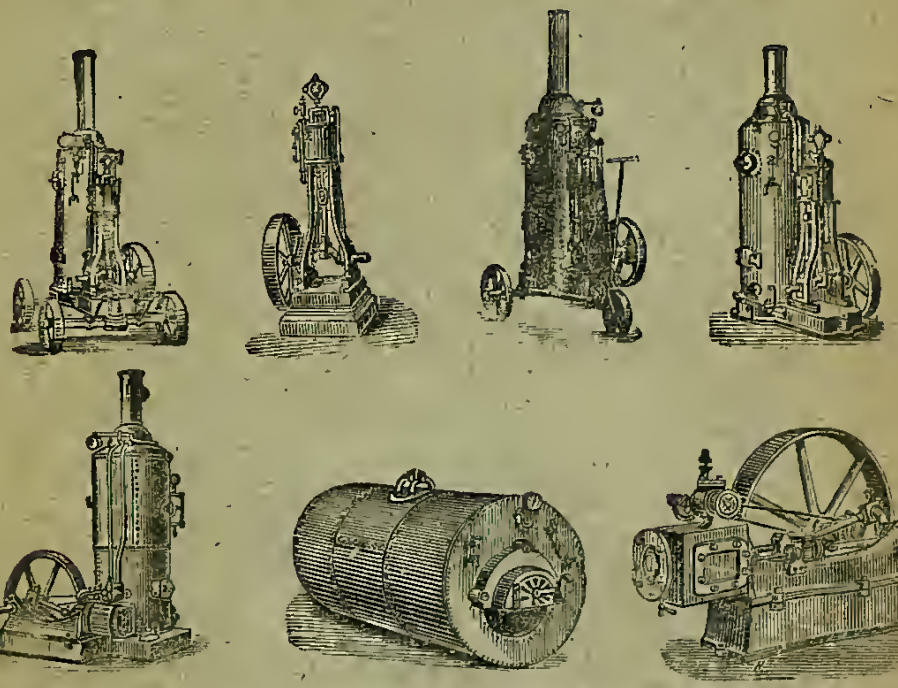

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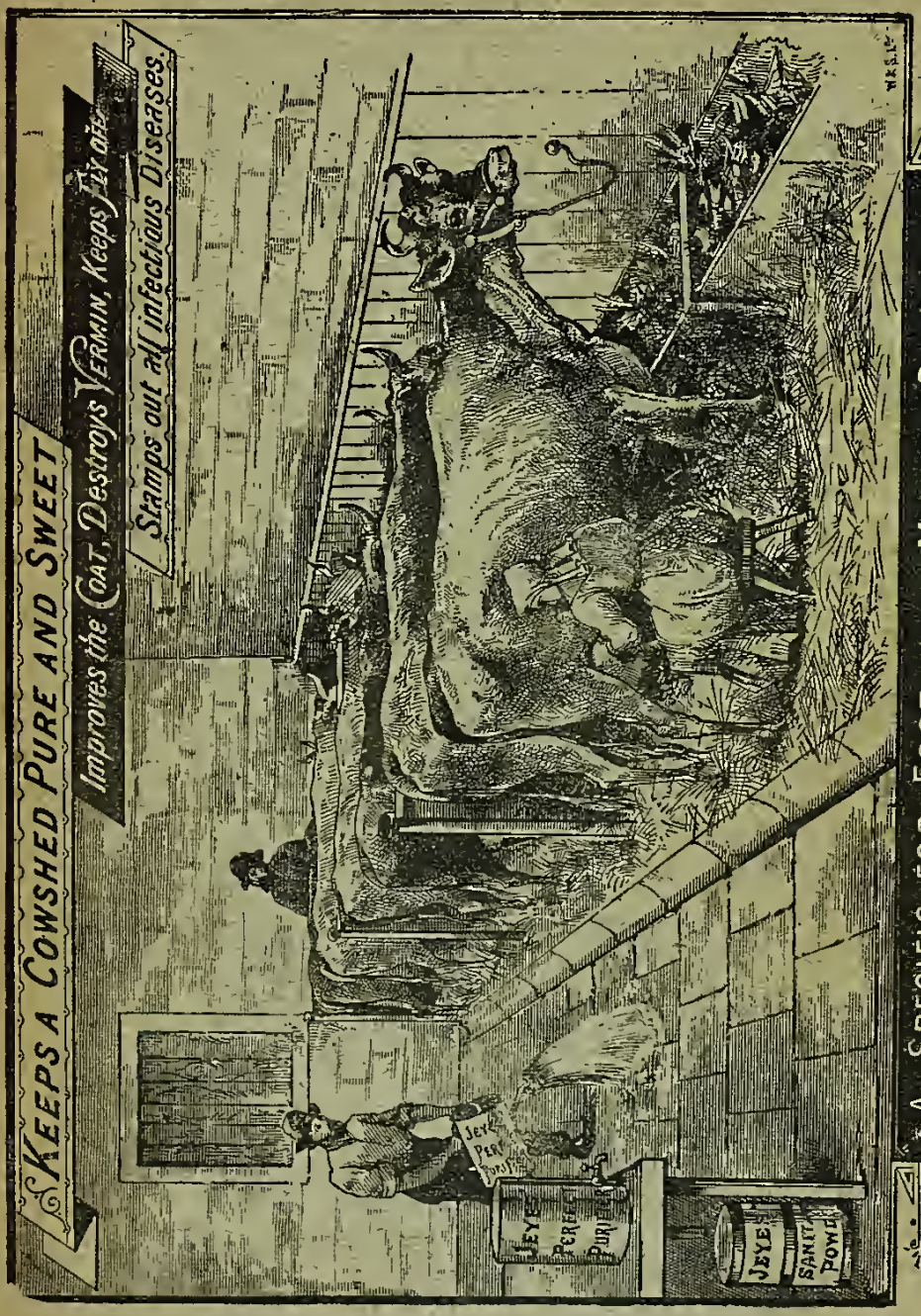

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Price List and all particulars on application.

THE DAIRY FARM.

LAVAL'S BABY SEPARATOR, AND SWEDISH DAIRYMAID.

[*Frontispiece*

THE DAIRY FARM.

BY

JAMES LONG,

LATE PROFESSOR OF PRACTICAL DAIRYING AND DAIRY FARMING IN THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER;
MEDALLIST OF THE ROYAL DANISH AGRICULTURAL SOCIETY;
AUTHOR OF
"BRITISH DAIRY FARMING," "THE BOOK OF THE PIG."

LONDON:
W. H. ALLEN & CO., 13, WATERLOO PLACE,
PALL MALL. S.W.

1889.

LONDON:
PRINTED BY W. H. ALLEN & CO., 13, WATERLOO PLACE. S.W.

THIS LITTLE WORK

IS

DEDICATED

TO

SIR THOMAS DYKE ACLAND, Bart.,

WHO, DURING A LONG AND EARNEST LIFE,

HAS BEEN DEVOTED TO THE INTERESTS OF THE

TILLERS OF THE SOIL,

AND WHO HAS DONE, AND IS STILL DOING, SPLENDID SERVICE IN THE

CAUSE OF DAIRY EDUCATION.

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CHIEF OFFICE:—

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CATTLE.

Dairy Shorthorns, Sussex, Jersey, Kerry.

PIGS.

Red Tamworth.

POULTRY.

Dark Dorkings, Silver Dorkings, Langshans.
Minorcas, Game.

DUCKS.

Aylesbury, East Indian.

"Mixed and Dairy Husbandry, and what may be comprehensively termed 'Commercial' Farming, is the *beau ideal* of the times. One of the finest examples of this farming is to be found on the Itchingfield Estate, belonging to the Aylesbury Dairy Company, situated about two miles from Horsham, in Sussex, and embracing an area of 1,400 acres."—*The Times*, July 18th, 1888.

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PREFACE.

SINCE the publication of *British Dairy Farming* and the *Book of the Pig*, I have been frequently asked for a simple and cheap, yet comprehensive work dealing with elementary instruction in Dairy Farming. Such a work I have attempted to produce, in the hope that it may be found serviceable to the large and increasing class of students in Agricultural and Dairy Schools, as well as to that section of our population which, interested in agricultural pursuits, is gradually becoming better acquainted with Dairy matters. I believe the book will be found clear and practical. Many of the details contained in the text have either been obtained or confirmed in my own practice; others, especially those which have a scientific basis, have been subjected to the examination of a friend, an eminent professor of chemistry. Whether the work has been done

well or ill, it is the result of combined study and practice which has extended over a number of years, and I hope it may prove worthy of the kind reception which my earlier works have obtained.

JAMES LONG.

ROMSEY, *March*, 1889.

THE

'Victoria' Cream Separator

Size B, 50 galls. an hour, £24.

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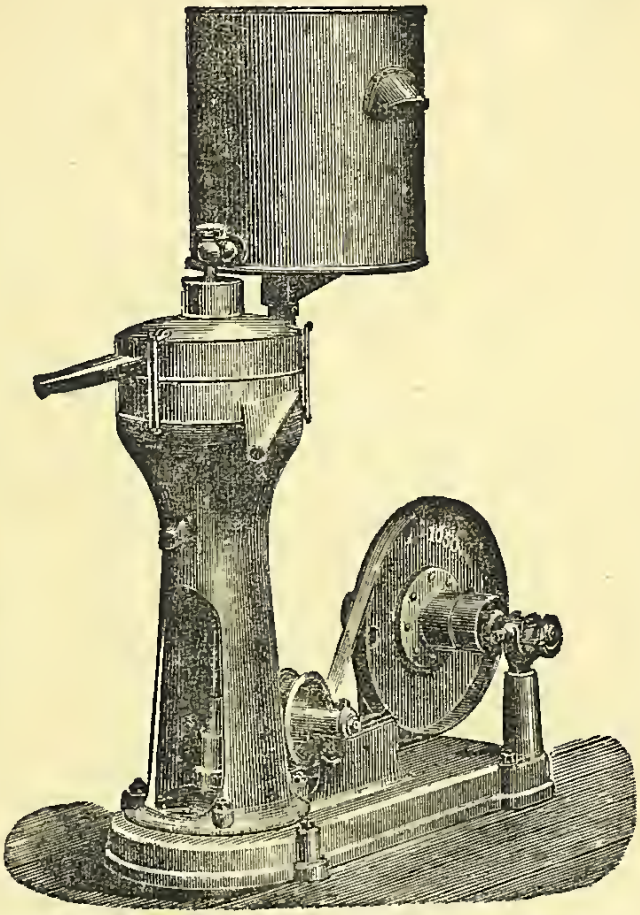

Table Separator for Hand Power.

OTHER SIZES, SEE LIST.

Has obtained the HIGHEST AWARD at the recent Bath & West of England Society's Show, at Newport, in the Cream-Raising Competitions.

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Dairy Engineers and Manufacturers of all kinds of Dairy Utensils,

VICTORIA TIN WORKS, WANDSWORTH ROAD,

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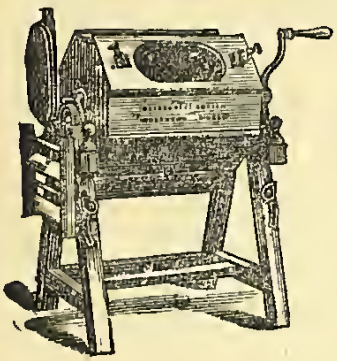
Estimates given for fitting complete large and small Dairies and Dairy Factories.

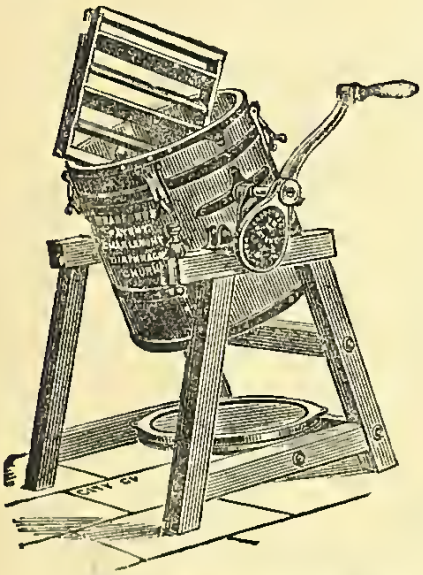
CONTENTS.

	PAGE
Milk	1
Cream and Cream-Raising	9
Milk-Selling	16
Butter-Making	19
Cheese-Making	26
Creameries and Factories	31
Ensilage	35
Cattle	39
Management of the Cows	46
Feeding	55
Pigs	60
The Dairy Farm	66
Hay-Making	77
Farm-yard Manure	83
Laying down Land to Grass	89
Irrigation	99
Dairy Farm Accounts	105
Index	113

Bradford's Patent "DIAPHRAGM" Churns.

"The Churn of Churns."





THE "Diaphragm" Churns are now recognized by the highest scientific and practical Dairy authorities in the United Kingdom to be *the best* Butter Makers (see page 5 of Catalogue) and we briefly explain their distinctive and practical advantages.

They mix the Cream perfectly.

They agitate equally every portion of the Cream from beginning to ending of the churning.

They ensure granulation into butter being simultaneous and certain—not one portion of the cream being over-churned and the other portion being under-churned, but *the whole churned equally*, hence *the perfect sample of butter they produce.*

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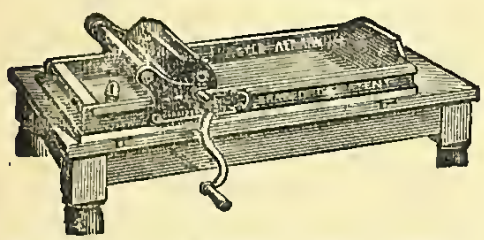

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The higher end is removable, and the fluted roller can be instantly removed from and replaced in the framework.

Bradford's Patent "Albany" Butter Worker. *See Catalogue.*

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Bold St., LIVERPOOL; Victoria St., MANCHESTER; & Crescent Iron Works, SALFORD

LIST OF ILLUSTRATIONS.

LAVAL'S BABY SEPARATOR, AND SWEDISH DAIRYMAID - - - - - - *Frontispiece*

THE FAT GLOBULES IN THE FIRST MILK DRAWN FROM A JERSEY COW DURING ORDINARY MILKING — THE FAT GLOBULES IN THE LAST MILK DRAWN FROM A JERSEY COW DURING ORDINARY MILKING—THE SUGAR IN WELL-MADE CONDENSED MILK—THE SUGAR IN IMPERFECTLY-MADE CONDENSED MILK — WELL-MADE SALT BUTTER—IMPERFECTLY-MADE BUTTER, SALTED WITH COARSE AND IMPURE SALT - - - - - - - *To face p.* 2

THE DANISH SEPARATOR — DIAPHRAGM CHURN - - - - - - - ,, 12

HINDLEY'S DAIRY ENGINE—GRAY'S MILK REFRIGERATOR—BRADFORD BUTTER BOXES—CREAMOMETER - - - ,, 18

GRANULAR BUTTER - - - - - - ,, 19

BUTTER MAGNIFIED 400 DIAMETERS - ,, 22

Oleomargarine Magnified 400 Diameters	*To face p.*	25
Camembert Cheese Dairy	„	28
Plan of the Dairy at the Royal Agricultural College, Cirencester	„	30
The Royal Agricultural Society's Champion Prize Silo	„	37
Shorthorn Dairy Cow	„	39
Kerry Cow	„	42
Jersey Cow	„	44
A Model Dutch Cow	„	48
Mr. T. Barham's Guernsey Bull "Climax" — Mr. T. Barham's Guernsey Cow "Lady-Bird"	„	57
Small White York Sow	„	60
Sow of the Small Black Breed	„	62
Lord Moreton's Piggery at Tortworth Court	„	65
Giant Caragua Maize	„	72
Thousand-Headed Kale—Kohl Rabi	„	74
Hay Press—Hay Horse-Rake	„	79 *or* 80
Timothy Grass (Phleum Pratense)	„	95

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A NEW AND MUCH IMPROVED VEGETABLE

BUTTER COLOURING.

This Butter Colouring is *Purely Vegetable*, and gives a rich clear straw colour to the Butter, exactly resembling the natural tint. *It does not colour the Buttermilk* or impart any taste or smell to the Butter.

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The Sandringham Dairy Herd Recorder (by Royal Letters Patent), and **Milk Record Sheets.** The simplest, easiest, and quickest way of keeping a Dairy Record.

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Pyramid Butter Boxes (Registered). A cheap, uniform, non-retnrnable Butter Package.

Safety Egg Boxes (Tully's Patent). Convey Eggs any distance by Road or Rail without Breakage.

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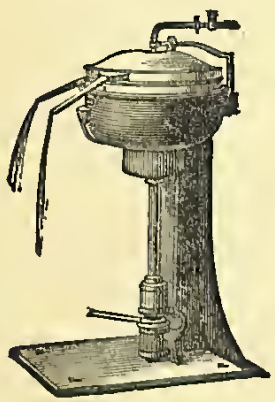

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(Requires no Engine, only a Boiler.)

The "Oscar"...Separates 90 gallons per hour ... **£46**
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Awarded 150 First Prizes, including the Gold Medal of the Royal Agricultural Society of England, the Gold Medal of the Bath and West of England Society, the Gold Medal of the Royal Liverpool, Manchester and North Lancashire Agricultural Society, and the Gold Medal of the British Dairy Farmers Association. **They have in every instance been awarded the highest honours at every contest in Great Britain, beating every Separator that has ventured into competition.**

The above are only a few of our specialities. For Further Particulars of these and every other Dairy requisite, Butter Workers, Refrigerators, Dairy Salt, Preservative, Testing Appliances, &c. you are earnestly desired to write for Illustrated Catalogue, free on application to the

DAIRY SUPPLY CO., LIM., MUSEUM ST., LONDON.

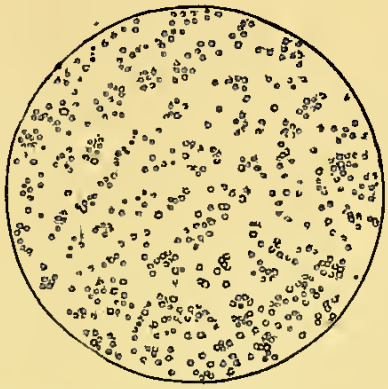
THE DAIRY FARM.

MILK.

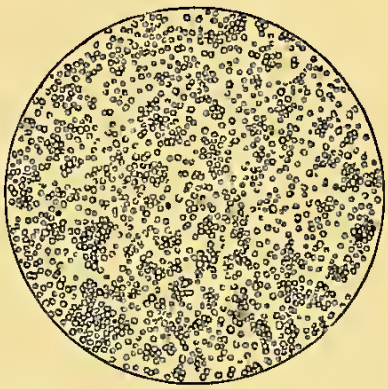
As the success of a dairy farmer depends upon his knowledge of milk manipulation, milk production, the manufacture of milk products, and the feeding, breeding, and management of his cattle, it will be necessary to discuss the various points in connection with each of these important branches of dairy-farming. It is evident that, in the first place, a knowledge of milk manipulation can only be grasped by one who understands the composition and properties of milk. Hence it will be advisable to make some remarks upon this all-important food, to the production of which everything contained in this book is directed.

What is milk? It is composed of water, a small quantity of mineral matter, and three important solid food constituents. These are sugar, which is found in the largest quantity, and which is the most constant quantity of the three; casein, the chief constituent of

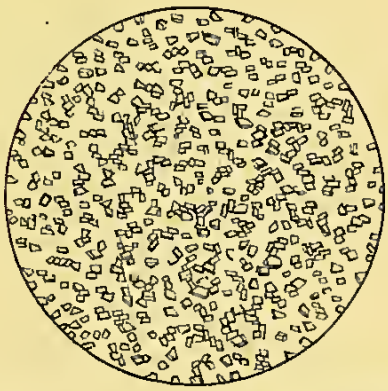
cheese; and fat, which is converted into butter in the dairy. The fat is generally the smallest in quantity, if we except the mineral matter; but it is the most valuable, and is found at the rate of from $2\frac{1}{2}$ lbs. per hundred, as in the milk of some Dutch cows, among pure breeds, and in ill-fed and badly-bred cows, to 6 per cent. in the Channel Islands and sometimes in the Devon breeds. Six per cent. is about the outside proportion of fat, but 5 per cent. is very common in the above varieties. Milk contains about $12\frac{1}{2}$ per cent. of "solids," a term usually applied to the constituents of milk without the water; but the percentage varies from 9 to 15, and sometimes more, and depends very much upon certain conditions which every dairyman should understand. Solids depend first, as already shown, upon the breed, and next upon the feed. A farmer producing milk for sale generally feeds less liberally than if he feeds for butter or cheese, inasmuch as the food liberally and judiciously arranged has a great influence upon the butter production. It depends also upon the time of milking the cow—the milk of the evening, though less in quantity, being usually richer in quality than that of the morning; so that in practice it is often found that, eliminating the water which composes the bulk of the milk, the evening's milk is actually as valuable as that of the morning. It depends also upon the season of the year. Milk in autumn is richer than in spring, and whereas it requires $9\frac{3}{4}$ lbs. to $10\frac{1}{2}$ lbs. of milk, upon the average, to make a pound of cheese between May and July, yet between August and October it only



THE FAT GLOBULES IN THE FIRST MILK DRAWN FROM A JERSEY COW DURING ORDINARY MILKING, AS SHOWN BY THE MICROSCOPE.



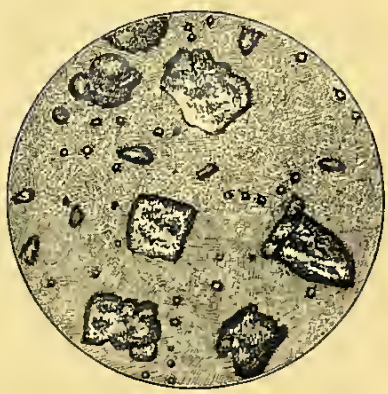
THE FAT GLOBULES IN THE LAST MILK DRAWN FROM A JERSEY COW DURING ORDINARY MILKING, AS SHOWN BY THE MICROSCOPE.



THE SUGAR IN WELL-MADE CONDENSED MILK, AS SHOWN BY THE MICROSCOPE.

THE SUGAR IN IMPERFECTLY-MADE CONDENSED MILK.

WELL-MADE SALT BUTTER, AS SEEN UNDER THE MICROSCOPE.



IMPERFECTLY-MADE BUTTER, SALTED WITH COARSE AND IMPURE SALT, AS SHOWN BY THE MICROSCOPE.

[*To face p.* 2.

requires from $7\frac{3}{4}$ lbs. to $9\frac{1}{2}$ lbs.—these actual figures being based upon returns of cheese made upon an enormous scale. The milk of a cow, too, is richer as she approaches the end of her milking season; and whereas her butter yield may only reach 3 to $3\frac{1}{2}$ per cent. two months after calving, yet eight to nine months after calving she frequently gives 5 per cent. of butter. Lastly, the richness of a cow's milk depends upon how it is taken from her. An example will suffice. A newly-purchased cow was to be tested for the richness of her milk, but she had to support her calf. The cowman milked, as he thought, about half her yield, taking some from each quarter of the udder, and leaving the remainder for the calf. The milk drawn was set for cream, but that which rose barely covered the surface. He had left the richest part of the milk for the calf to take. The first portion drawn is always the poorest, and the milk increases in richness until the last drawn, which is almost equal to thin cream. As it is clear that fat is such an inconstant quantity in milk, and is affected so easily, it is quite clear that the butter-maker has much to contend against, not only in obtaining cattle which yield abundant fat, but in extracting that fat from their milk.

There are various methods of ascertaining the quantity of fat which milk contains. The best method is the churn; but it is essential that the person making the test shall be master of his business, or he may fail first to obtain all the cream from the milk, and next to obtain all the butter from the cream—failure in

both cases being of daily occurrence. The best scientific test is that of chemical analysis. Members of the principal agricultural societies can obtain information from the chemists of their societies upon payment of from 2s. 6d. to 3s. 6d. per sample. The next best simple test is made by the Marchand testing tube, in which a measured quantity of milk is mixed with equal quantities of ether and alcohol. The graduated tube containing the mixture is plunged into water at 104 degrees Fahrenheit, when a solution of fat rises to the surface, and from the volume of this fatty layer the percentage of butter fat is ascertained. The lactometer is an instrument to test the specific gravity of milk. This specific gravity, or density, gives an indication of its purity; but it is not always reliable unless the same milk is also set in a creamometer, in order that the cream may rise and thereby show that the milk has not been watered and the cream extracted. Alone the creamometer is of little value, as bulk of cream is not a perfect indication of the quantity of fat the milk contains.

In some dairies it is customary to strip the cows after the milkers, the strippings being sold at double the price of new milk on account of their greater richness. Sugar of milk, which is not so sweet as cane sugar, is the leading medium of the fermentation and decay of milk, for by contact with the air it is transformed into lactic acid, causing the milk to coagulate. As sugar is a food of great value, milk is easily depreciated by the loss of the sugar it thus sustains when it becomes very sour. The sugar is

useful to the cheesemaker, as it enables him to create a certain amount of acidity which assists in producing cheese of the highest type. Sugar can be extracted from the whey of milk by evaporating the water, when it will be found in the residue combined with a small amount of fat and casein. The casein—sometimes called curd, but not correctly, inasmuch as the curd of new milk contains almost the whole of the fat—is the nitrogenous portion of milk responsible for flesh-making, and requiring in its production nitrogenous foods, such as cotton-cake, beans, peas, lucerne, tares, &c. Casein is precipitated by rennet, a preparation from the fourth stomach of the calf. It is found in badly-made butter, from which it cannot be removed unless the butter is made upon the system hereafter described, by means of which it may be entirely washed out. There is also a small quantity of albumen found in milk, which is generally included in the term casein, as both are similar; albumen, however, is not precipitated by rennet, though it is by heat, and it therefore remains in the whey, from which it is often extracted, together with the sugar, in Switzerland and in Norway, for conversion into a peculiar kind of cheese. By the extraction of the fat, the casein, and the sugar from milk, we obtain a residue which is almost pure water.

New milk with, according to the average standard, 12½ per cent. of solid matter, contains per gallon about 20½ ounces of the solids referred to above, divided as follows:—5½ ounces of butter fat worth 5½d., 7 ounces of sugar worth a 1d., and 7 ounces of

casein worth 3d.; but rich milk such as that given by the Jersey, containing 14¼ per cent. of solids, is worth at least 2½d. more for its fat value and a 1d. for its other solids. Thus it would be worth 1s. per gallon, for practically the whole of the constituents are digestible, so that no waste need occur when it is used as food. Skim or separated milk is that which remains after the cream has been removed; it contains about 15 ounces of sugar and casein to the gallon, and this is worth from 4d. to 6d., the value depending upon its richness in casein and its freshness, but it does not actually obtain its full value in the market.

Butter milk is the milk remaining in the churn after churning the cream and extracting the butter. This is still more valuable than skim milk, for it contains a larger percentage of solids; it is highly valued in Ireland and in some manufacturing districts in England, where it is consumed sour, but when sweet it is not only nourishing but rich and refreshing. Colostrum is the milk yielded by the cow during the first few days after calving. It is not fit for consumption until it will boil without coagulating. The colostrum really contains a small portion of a membrane which peels off when the cow first calves, and is passed through the udder into the pail. In dealing with milk it should always be by weight rather than by measure, inasmuch as, like water, it expands and contracts with heat and cold. Thus a vessel of milk measured by the graduated scale would appear to contain more if the milk were measured when hot than if it were measured when cold, but no variation in weight occurs.

The specific gravity of milk is only slightly variable, as shown by the lactometer or milk gauge. As water weighs 10 lbs. to the gallon, so milk weighs 10·28 to 10·35 lbs. A lower specific gravity shows that it approaches water in density, while a higher specific gravity indicates a low quality from loss of cream, cream being similar in specific gravity to water itself. In manipulation, especially where milk is sold or has to be kept for a period of time, or in very hot weather, it should be aërated, cooled, or heated. Aëration removes animal odour and the taints of the cowhouses, all of which milk seems to have a great capacity for absorbing. Directly it is milked into the pail it is attacked by organisms which are always in the air in greater or less numbers. These organisms thrive and multiply at blood heat. They are killed at a high temperature, and are rendered torpid at a low temperature. If, therefore, milk is immediately cooled to 40 or 50 degrees, their influence is slowly exerted, and the milk remains sweet for some time. Milk is rapidly destroyed the nearer it approaches to 98 degrees; for travelling, therefore, or for keeping, it should always be cooled to a low temperature; but in very warm weather, when it may be attacked by the organisms to a large extent, it can be heated to 170 degrees (by which means they are killed), and rapidly cooled to 45, and so maintained, when the new organisms which at once attack it are, as before, rendered helpless.

Milk if infected may be rendered harmless and maintained sweet by sealing it in bottles, and sub-

sequently plunging these in boiling water for a few minutes. If this plan were universally adopted, there would be no danger of attack from disease through the medium of milk. This plan is more especially necessary in thickly-populated towns, where dangerous organisms are present in the air to a much greater extent than in country places, especially at high altitudes. Milk should never be put into dirty vessels, for similar reasons, inasmuch as the organisms invariably adhere to these, but can be destroyed by scalding. For similar reasons a cow should never be allowed to drink from dirty ponds or streams, which are invariably abodes of injurious organisms.

CREAM AND CREAM-RAISING.

CREAM varies in colour as in quantity with individual cows as well as with distinct breeds. In the ordinary way its variation in bulk depends solely upon the temperature. If raised at a high temperature it is thick and rich, but raised at a low temperature it is extremely thin. Ordinary cream is very slightly heavier than water, but when it can be taken from milk without the adherence of much casein, it is lighter than water. At a low temperature its specific gravity more nearly approaches that of water, and thus it is that it does not rise so freely in cold weather. The rising of cream depends mainly upon two factors—specific gravity and temperature. Water is a better conductor of heat than fat, of which cream is largely composed. If, therefore, fat rises upon water because it is lighter, it follows that when the difference in specific gravity between the two is increased by a fall of temperature the cream rises more quickly. This, although it is not generally understood, is why the cold or deep-setting

system of cream-raising is so successful. If new milk, fresh from the cow, is placed in a deep vessel of say 20 inches, at 90 degrees Fah., and plunged into cold water at 45 degrees, it has 45 degrees of temperature to fall through. The water feels the change of temperature before the cream, being a better conductor; hence the difference in specific gravity is increased, contrary to the belief of those who still follow the old shallow system, and the cream rises in half the time.

If new milk is refrigerated directly it is drawn, the cream rises more slowly than under any other condition, for the fats of the cream contract just as readily as they expand; hence the cold setting of cold milk is the worst possible practice, whereas warm setting is a good practice where the pans are shallow, except in hot weather, when the milk is more liable to become sour. Thus in Switzerland cheese-makers heat their whey to enable the fat it contains to rise quickly. Shallow setting is faulty in practice, however correct in theory, because it cannot be controlled. If we could always set milk in shallow vessels from 2 to 4 inches deep, at 60 degrees, we should obtain good results; but the temperature of almost every dairy varies with the weather, and when the milk is subjected to a temperature higher than 60 it is liable to spoil before the cream has all risen. On the contrary, when it is subjected to a low temperature a portion fails to rise, and there is a loss of from 10 to 15 per cent. Shallow setting in a large dairy demands a special apartment which provides a large amount of

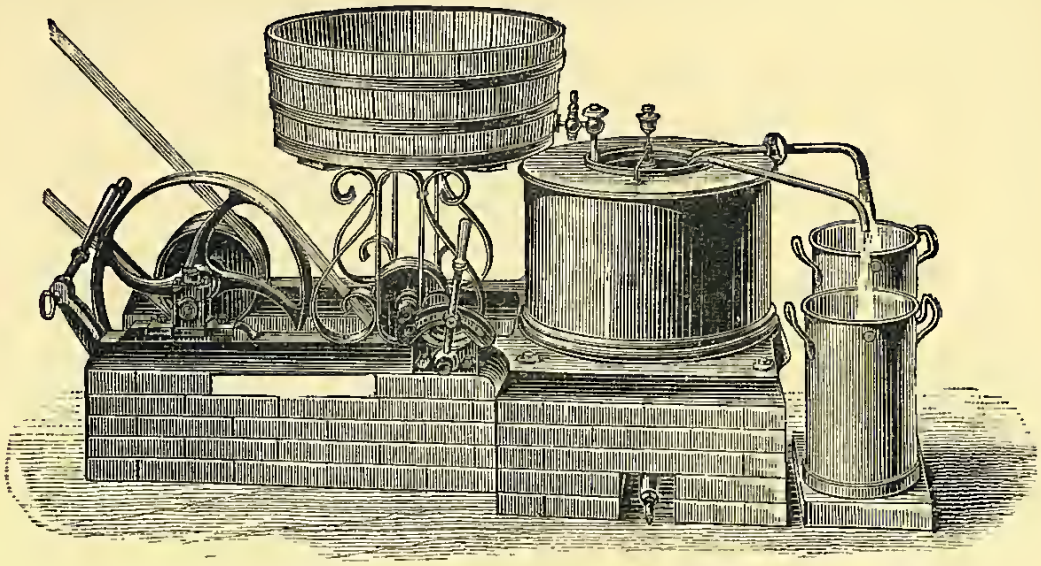
space. The milk, too, must often stand for 48 hours, and even then the cream is not all thrown up. Both the shallow and deep setting systems are correct in theory, but deep setting alone can be controlled in practice, hence where it is practised the returns in butter are invariably larger. If two quantities of milk from one vessel are set in an apartment maintained at 40 degrees, the one being set when it is at 90, and the other when it is at 60 degrees, we shall find that the first-named will have thrown up all its cream in 12 hours, whereas the latter will not have thrown it up in 24 hours, and, indeed, a portion will inevitably be lost. The two best known plans of deep setting are the Swartz and the Cooley. In the former the milk is placed warm in 20-inch deep oval cans without lids, plunged into a tank at not more than 45° F., whereas in the latter case round cans are used, and these are placed in a refrigerator at 50 degrees or less, and entirely covered with water, a lid being provided to exclude it. The cream rises in both cases upon the same principle, but the exposure of the cream to the air in the case of the Swartz has an influence which improves the flavour of the butter made from it. In both cases the cream is always thin. The Swartz plan demands ice in hot weather, one pound of which is equal to cooling about 100 lbs. of milk.

The Devonshire or scalding system is one of considerable value when it is rightly controlled, for success depends largely upon the temperature, as in the case of the shallow setting. If milk is set while

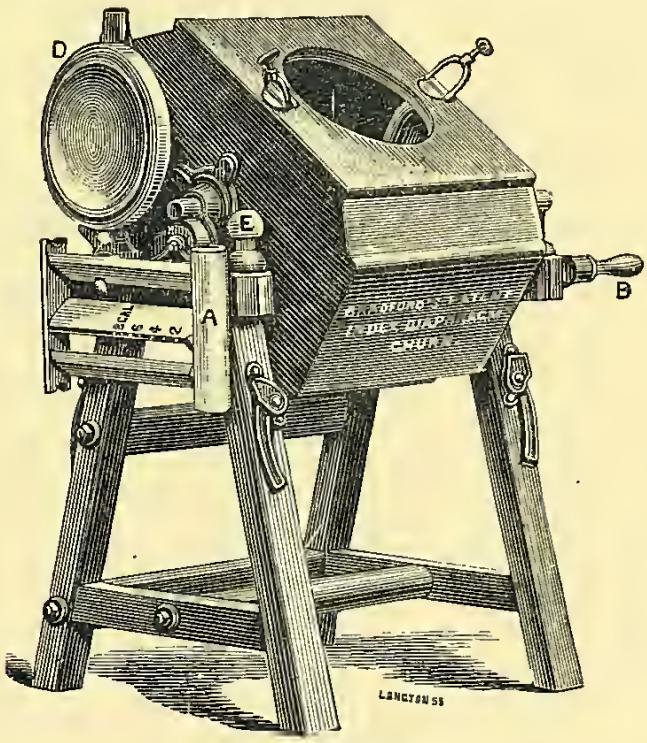
warm in an apartment at 60 degrees, it will have thrown up the bulk of its cream in 12 hours. If it is then scalded at not higher than 180 degrees, and again returned to the same apartment, the falling temperature will influence the quick rising of the remaining cream globules which had not previously risen.

The cream Separator is undoubtedly the best of all systems, and now that hand machines can be obtained it is within the reach of the smaller class of farmers, who will in future be able by its aid to practically obtain the whole of the butter their milk contains. Centrifugal separation is the most rapid and certain of all processes. By pony, steam, or hand power, from 20 to 150 gallons of new milk can be creamed within an hour after milking, although this cream is not fit to churn, from the most profitable point of view, until it has been ripened either artificially or naturally. The whole of the dirt is removed from the milk—a most important consideration—and the skim milk is left in a form which is immensely superior to that of skim milk obtained under any other process. The action of the machine is simple. By rapid revolutions the lightest portion of the milk, *i.e.* the cream, is thrown up to the surface and either skimmed off by tubes or forced out of the machine by the pressure of the inflow of new milk.

Churning milk does not properly come under the heading of creaming, but it is a process that should be understood, as it has a certain value. It entails far greater labour than other processes; it produces a very sour butter-milk, and the butter made generally



THE DANISH SEPARATOR.



DIAPHRAGM CHURN.

A. Diaphragm. B. Handle. D. Lid. E. Plug.

[*To face p.* 12

contains too much water. On the other hand, no dairy is necessary, and no milk-setting utensils are required, whilst the percentage of butter obtained is very large indeed. It is necessary to churn milk which is quite sour, which, in fact, is coagulated, to obtain the best results, as churning sweet milk is most unprofitable, a large percentage of butter being left in the butter-milk.

To obtain the best results in butter-making—*i.e.* quantity and flavour of butter—it is necessary that the cream should be ripe. Ripeness, so called, is the first stage in decomposition or souring. Cream exposed in a dairy at 60 degrees will be ripe for churning in 12 hours; but in cold weather, when the temperature is much lower, it is necessary to add a small quantity of sour cream or sour butter-milk if we wish to churn in 24 hours. The quantity can be ascertained only by practice. When cream, after skimming, is poured into a vessel, upon other cream previously placed there, the whole should be stirred, and the stirring should continue after every fresh addition, in order that each lot may be brought to the same stage of ripeness. If not stirred, the different creams would be in separate layers, and some would be riper than others. This would entail a loss when churning took place, for one cream would require longer time in churning than another to yield up its butter.

An important business is now being conducted, not only in Devonshire with clotted cream, but in other parts of the country with raw cream sold in its sweet state and in small quantities. There is too little know-

ledge of the actual value of cream for sale. This can be ascertained by any person with little trouble, whether he sets his milk, separates it by machinery, or places it in a vessel known as the Jersey Creamer for 12 hours. In each of the latter cases he can obtain it thick, and obtain almost all. Having weighed the milk, and subsequently weighed the thick cream raised, he can always price it so as to repay himself. Thus 10 gallons, or 100 pounds of milk, charged to the farm at 7d. a gallon, would be 5s. 10d. If, then, the cream yield was 15 per cent. when drawn thin, about six quarts would be obtained. If this were sold at 4d. the half-pint, the return would be 8s. the 100 pounds of milk, showing a profit above the price charged to the farm of 2s. 2d., and yet the skim milk would be left. Four-pence for a half-pint of thin cream, however, is supposed to be absurdly low, and yet it might be sold in very large quantities by the tumbler, just as milk is sold at 1d. per glass. Supposing the skim milk were sold at 3d. the gallon, it would return 2s. 1½d., or in all 10s. 1½d., showing 75 per cent. profit. Milk yields little more than half the quantity of thick cream mentioned above, so that to obtain the same return it would have to be charged at 8d. the half-pint, or 2s. 6d. the quart, yet in practice what is called thick or double cream is commonly sold at 4s., although it is certainly not equal to such cream as that to which we refer. The sale of clotted cream in Devonshire might be largely extended if makers would use greater efforts to send it out in such a state that it could be kept for a longer period without be-

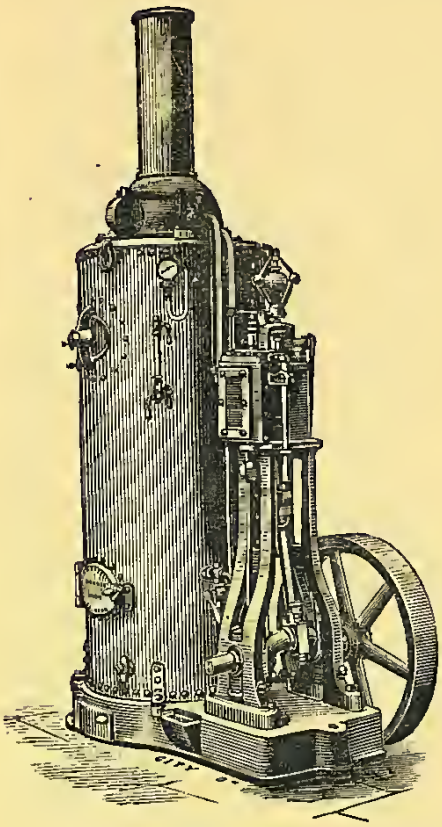
coming sour. One plan is to enclose it in tin cases which are hermetically sealed. Another plan is to use a very small portion of boracic acid, which is believed to be entirely harmless, and which has a great preservative power. Makers should endeavour, too, to arrange that their cream, being a perishable article, should be kept in a refrigerator, as raw cream is constantly kept in American shops during hot weather. There is no reason why clotted cream should not be exported to France and other countries just as easily as double cream-cheeses made by Pommel and Gervais, are transported to, and largely consumed in, this country.

MILK-SELLING.

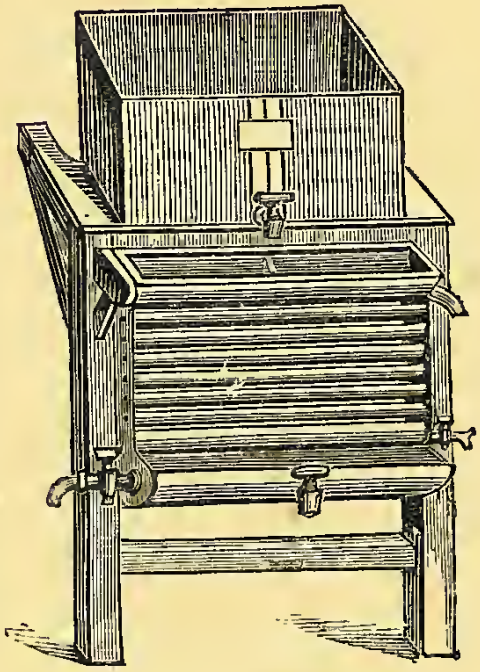
SETTING aside the price obtained for new milk in exceptional situations, the milk-selling farmer usually obtains about 1s. 4d. a barn gallon of 17 pints for the year. His contract is generally made for the six winter months at 1s. 6d., and the six summer months at 1s. 2d. In some cases he obtains a higher price, in others slightly lower. Supposing that he pays a penny per imperial gallon for carriage, and allowing a penny for the surplus pint, he appears to receive about 6½d. per imperial gallon for his milk. The other expenses outside the cow-house are practically limited to the cost of conveying to the station, and the majority of farmers require to keep a horse and cart almost entirely for this purpose! Jersey milk always obtains a higher price on account of its known greater value. When the contract is made the farmer is obliged to keep up his supply, and he is therefore compelled to purchase cows at various times, whether they are dear or not. If, however, the yield is excessive, he is often compelled to deal with it himself,

and in some cases he has to retain his Sunday milk. The plant required for a milk-selling dairy consists of railway churns, which are made in three sizes, four, six, and eight barn gallons, varying from 23s. to 35s. each in cost. They should be of steel made in one sheet, having strong rims at the bottom, and lids which admit air but no rain or dirt, and which can be locked down. A refrigerator is also required, with a vat, into which the milk is poured. This necessitates a supply of cold water, which may be pumped from a deep well into a tank above the refrigerator. When the milk is being cooled the water passes through the machine by means of a pipe connecting it with the tank, and back again into the well. Milk poured into the vat at 90 degrees should come out, even in summer, at no higher than 50 degrees. Beyond these utensils nothing else is required but milk-pails, unless the surplus milk is made up weekly, when a churn and butter-making utensils will be requisite. In summer the milk-seller is liable to have his milk returned if it is not thoroughly sound and well cooled—a long journey in very hot weather often causing it to turn sour. It must also reach a certain standard of quality, or the seller is liable to sacrifice his contract and to a fine. This standard should never be less than 12·3 per cent., but 12 per cent. of total solids, if the constituents are in the right proportion, is usually accepted by the magistrates as a criterion of genuine milk in cases coming under the Adulteration Act. By keeping a record of the quality of the milk given by the various cows, the owner can detect

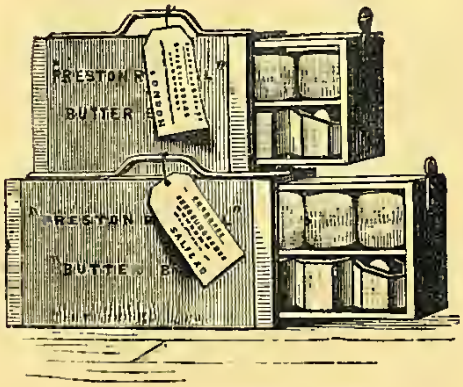
those giving poor milk, and these should be discarded as soon as possible, or they may reduce his entire produce below the required standard. Some farmers send raw cream with their milk for sale. This has been a lucrative business in the past, but London dealers are now able to produce their own cream from the milk they purchase, by means of the separator, and to deliver it in a fresher condition.



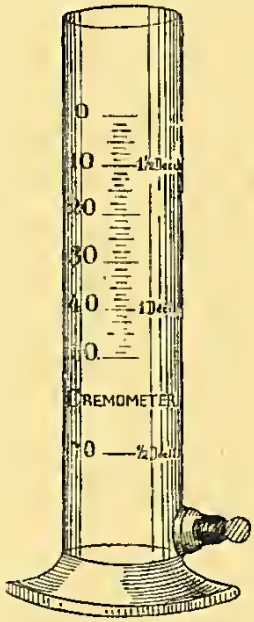
HINDLEY S DAIRY ENGINE.



GRAY'S MILK REFRIGERATOR.



BRADFORD BUTTER BOXES.



CREAMOMETER.

[*To face p.* 18.

GRANULAR BUTTER.

[*To face p.* 19.

BUTTER-MAKING.

THE profits in butter-making depend chiefly upon the yield obtained. One pound of butter can often be extracted from two gallons of the milk of selected breeds of cattle, and no cows should be retained which yield less than one pound to 25 lbs. of milk, a little less than 2½ gallons. In any case, if the butter is well made and always uniform in quality, it should return at least 1s. 3d. a lb. throughout the year. The skim milk under most conditions should be sold if possible, or converted into cheese in preference to pork or veal. The skim from two gallons of new milk should produce 4d. if it is sold at a nett price of 2½d. the gallon, so that each gallon of milk should return 8½d., a really good average price which every butter-maker should strive to obtain; and this he certainly can do if he carefully selects his cows, separates the cream by machinery, and makes his butter thoroughly well. The ordinary maker using three gallons of milk to each pound, and making his butter badly, realising only 1s. a lb. throughout the year, and feeding his skim

milk to stock which returns no more than a penny per gallon, only obtains 4½d. a gallon for his new milk.

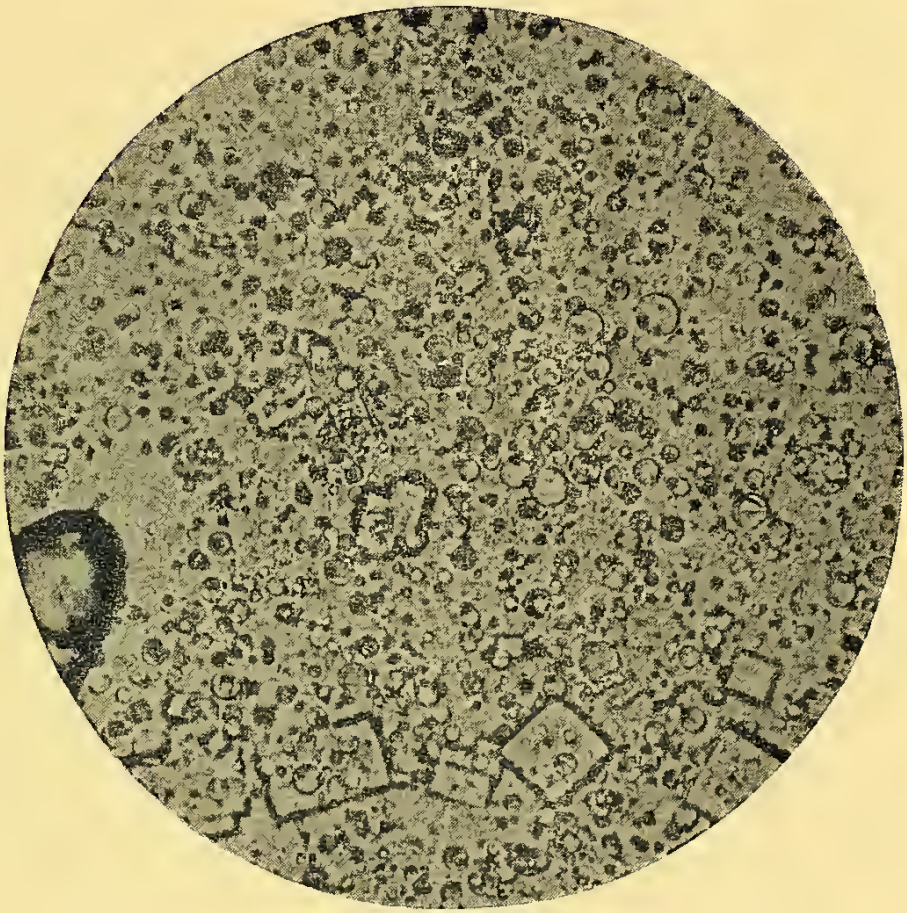
We have already seen what actual food skim milk contains, and this information should be conveyed to the public, as it will induce them to buy an article of which they hitherto have had a somewhat poor opinion. In butter-making the plant necessary is somewhat extensive. An ordinary dairy of 30 cows would require a separator costing from £25 to £38, together with a small steam-engine or gas-engine, or the use of a strong horse. This is the principal outlay. At the same time, either of the deep-setting systems may be adopted at less cost and nearly equivalent results. The deep-setting system of Swartz could not, however, be adopted with success, unless water at 45 degrees could be obtained in July. If this is at hand, all that is required is a brick and cement vat, 4 to 6 feet by 2 to 2½ feet, and 2 feet in depth. It must be watertight, with a plug at the bottom, and a supply and overflow pipe at the top. The set for a 30-cow dairy would cost from £12 to £15. The Jersey creamer would probably cost as much money, and occupy more space, but it has the advantage that it can also be used as the shallow system and as a high-temperature system.

The butter-dairy should always be in as cool a position as possible, with every window and door shaded from the sun. At the same time it should be perfectly dry, and fitted with shelves and floors which are non-absorbent. To these ends there is nothing

better than a thatched roof, double walls with ventilating apertures, slate shelves, and concrete floors with shallow gutters which are carried entirely through the wall. Such importance need not be attached to a milk-room where milk is not set but separated, nor to the churning-room, which, however, should be perfectly clean, and provided with a current of air. If steam is employed, the churn and butter-worker, together with the "delaiteuse" and butter-press, if these are also used, should be connected to a shaft by means of pulleys. The best churns are those which have large mouths, to enable the dairy-maid to put both arms in for removing the butter and cleaning the churn, and they should if possible have either moveable beaters or no beaters at all, such as the Holstein, the Diaphragm, and the End-over-end.

The best worker for steam power is the revolving circular table with a fluted roller. For hand-power, the rectangular table is the best. Upon this table butter can be both worked and rolled up. When reversed it forms a making-up table. In practice, the cream should be put into the churn at 58 degrees in hot weather, and 63 in cold, varying with the temperature. In cold weather, churning should be conducted in a room at 60° Fah.; and in hot weather, the churning-room should not exceed 58°. Milk when churned should be 66 degrees. The churn should not revolve too rapidly; so as to break the globules, but not to smash them. It should be provided with a small glass window. Upon this the cream spreads, and when the butter commences to come, it clears, the butter-milk being less thick. At

this moment, too, a change is also heard in the splash of the liquid, which closely resembles that of water in its sound. When the change of sound takes place, and the butter is "broken," as it is termed, the churn should be opened to see the state of affairs. If the butter floats in fine grains, the size of hemp-seed, the churning may be stopped. If not, a few more slow turns may be given until this condition is reached. The churn should then be fastened and the buttermilk drawn off through a strainer into the pail beneath. Cold water should then be added at a much lower temperature. A few gentle rocks may then be given to the churn, in order to wash the grains of butter, and to prevent them uniting. This water should next be drawn off, and more added two or three times, until that drained off last is perfectly clear. Salting should then take place. Some persons prefer to salt butter with solid salt. This is often the cause of streakiness in the grain, the salt not being properly dissolved, and attracting the moisture which the butter contains. Others prefer to salt the cream—a much better practice; but brining is the best plan of all. In proceeding to add brine to granular butter, it must be remembered that the butter holds a large quantity of water which is not drained off. Supposing the churn contains 50 lbs. of butter, we may add 6 gallons of water; since each gallon requires 2 lbs. of salt, this with $2\frac{1}{2}$ gallons, about the average quantity the butter holds, would require 17 lbs. of salt. The water may be added, and the salt simply thrown in, a few turns being given to the churn to mix and dissolve it. The



BUTTER MAGNIFIED 400 DIAMETERS.
The square crystals are those of salt.
(From the New York Commissioners' Report.)

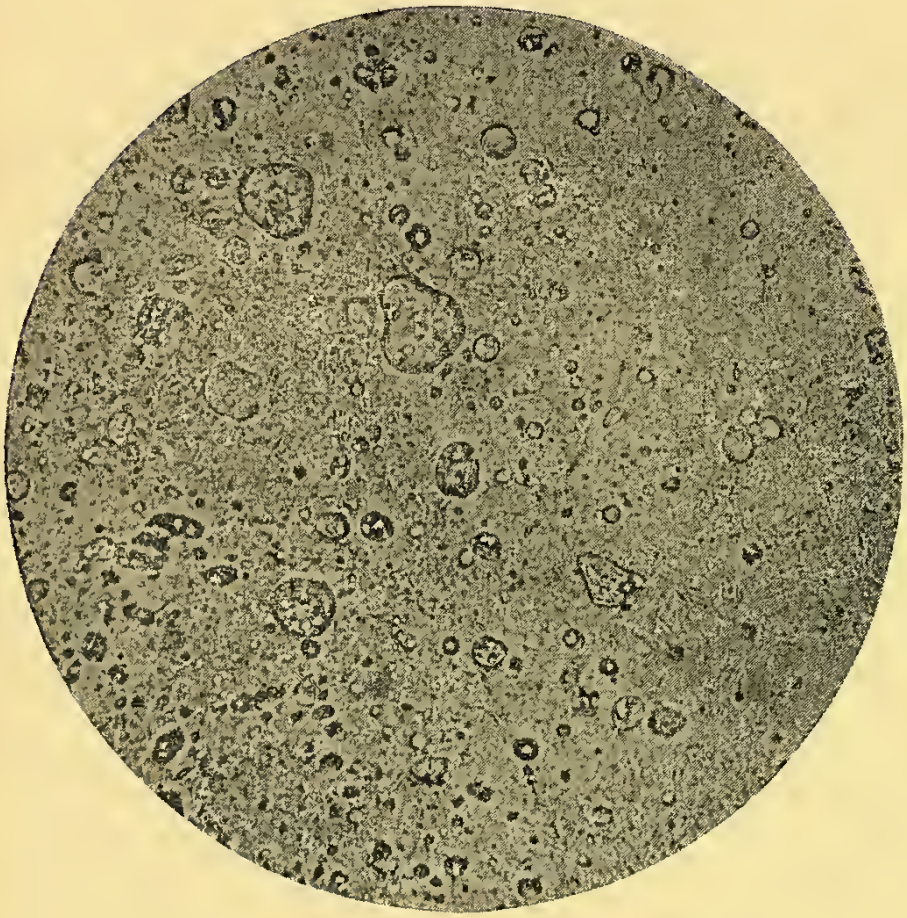
[*To face p.* 22.

butter should then remain in this condition with the lid off the churn for 3 or 4 hours, when the brine may be carefully and thoroughly drawn off. If too salt, a single light washing of pure water will weaken it—every control being obtained by the use of brine. The brine itself may be used over again three or four times, care being taken to add sufficient salt each time to balance the water which the fresh-brought butter always contains. If butter is to be very slightly salted indeed, ten minutes' brining will be found sufficient. Being drained, the next plan is to remove the butter, by means of a scoop, into the canvas bag prepared for insertion into the "delaiteuse." This machine revolves rapidly, and can be worked by hand or other power. The water is extracted by centrifugal force, and the butter left is in its driest condition, always purer than that made by any other process. From the "delaiteuse" it is removed to the butter-worker, where it is thoroughly kneaded, and made homogeneous. It should then be carried to the side of the butter-press, which stamps out accurate pounds or half-pounds with great rapidity —at least 30 to 40 being done while the dairy-maid makes up one pound by hand.

If butter is to be despatched by rail, as fast as it is made it should be rolled in damp butter-cloths and packed in boxes lined with clean paper. As each box is filled, it should be removed to a cooler or cold cellar, that the butter may harden so as to be ready for despatch by night train. In hot weather butter should always be made between ten at night and four in the morning to prevent softness and loss. Objection-

able as colouring is, where butter is naturally white, it is necessary to meet the wants of the public. For this purpose liquid annatto is used, but the maker should observe and maintain a certain tint neither too light nor too dark. The best plan, however, is to use at least two Jerseys to every twenty cows of the Shorthorn or Ayrshire breed. If the conditions suggested are fulfilled, butter will generally come in thirty-five to fifty minutes. Should it exceed an hour the temperature should be tested, and the cream warmed if it is too cold. Churning cold cream only incites sleepiness, when it may be churned all day without result.

Clotted cream butter should never be made by hand, indeed the hand should never touch butter under any conditions. Clotted cream should be churned at 58 degrees and not so rapidly as raw cream, when the butter will be brought in a similar granular form. Where butter is packed, it should be thoroughly worked by a machine, and laid in clean crocks in layers of a thickness of half an inch, the bottom being first covered and then the sides. Care must be taken to press each layer so as to exclude the air. If properly made and packed, and the surface covered with muslin upon which a layer of salt is placed, the butter will keep for some months; but the whole of the casein which is the usual cause of rancidity, must have been removed in the washing process. Salt will not preserve butter which is badly made, the removal of the casein being the all-in-all of success. A few more points in butter-making may be noticed. In cold weather the churn should not be cold or it will cool the cream. It should



OLEOMARGARINE MAGNIFIED 400 DIAMETERS.
(From the New York Commissioners' Report.)

[*To face p.* 25.

therefore be scalded before the cream is poured in. Cream should always be strained. If the churning is too slow the butter is longer coming, if it is too quick it comes in a soft and greasy form.

The salt used in butter-making should always be the purest. Pure salt does not absorb moisture like inferior salt, but will remain dry in an ordinary apartment. Butter well made and firm should present the appearance of broken cast-iron when a roll is broken in two. All wooden implements in butter-making should be prepared before use by scalding, rubbing with dry salt, and cooling with cold water. When butter is brought into a lump by churning, it encloses some butter-milk, the casein of which can never be thoroughly expelled. In making up butter which has not been passed through the delaiteuse, the best plan is to cover the table with a damp cloth which is properly strained over it. When making on a large scale, one person should mould the butter in a mould fixed in the table, the roll being lifted and expelled by pressure upon a treadle, while another finishes the butter off.

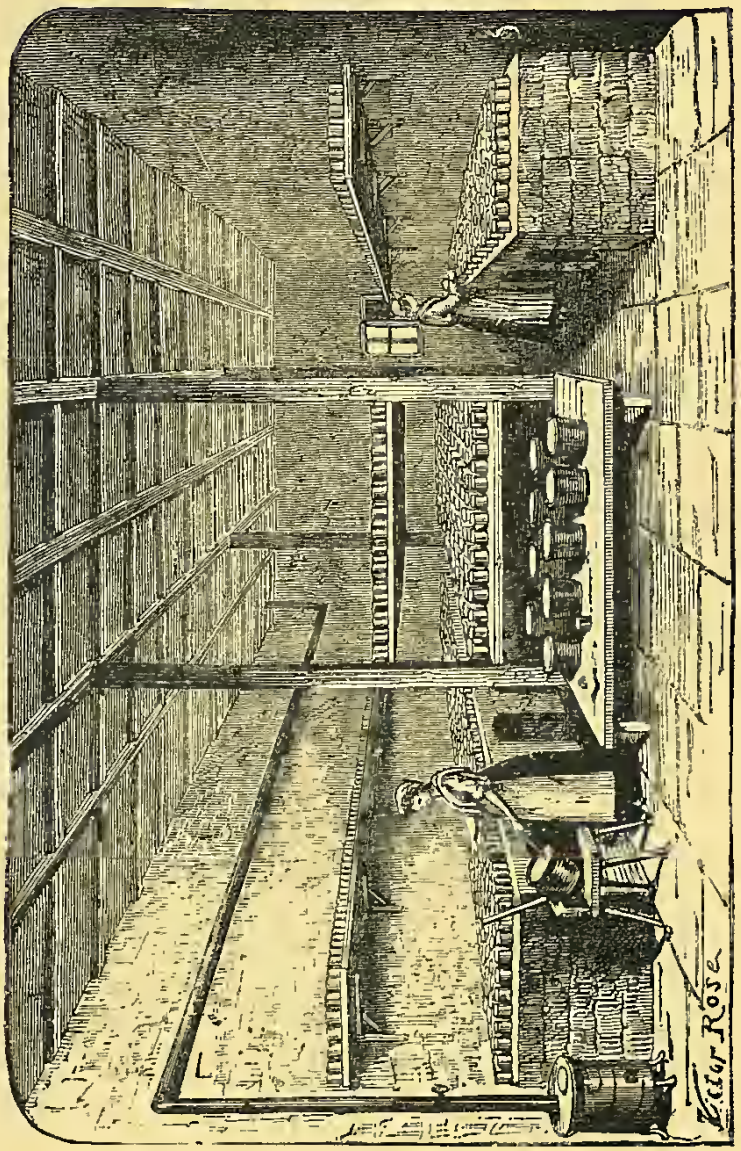
CHEESE-MAKING.

CHEESE-making requires specially arranged apartments, and these must be adapted to the requirements. of the particular class of cheese which is to be made. The erection of cheese-rooms in Cheshire is chiefly undertaken by the landlord, as the work is permanent. Three departments are generally arranged, the one for the reception of the milk, another for the making of the cheese, and a third for storing and ripening the cheese. The two former rooms are generally side by side. The third is above the cheese-making room, so that the new cheeses, which are very heavy, are sent above from the table by means of a lift, down which they also come and pass out at the window when delivered to the factor. As it is brought from the cow-house the milk is poured into a rectangular cheese-vat, either directly or through a receiver outside the dairy. In the latter case the milk passes by a tube into the vat. The cheese-vat has a jacket which is filled at night with cold water, to keep the milk fresh and prevent the cream rising. In the morning the new milk is strained

and added. The cold water is drawn off and the jacket filled with hot water, the milk being thus heated to the required temperature of from 80 to 90 degrees. The rennet is then added, the quantity being ascertained by experience; and the milk having been stirred for 20 minutes to prevent the cream rising, the curd is brought in 50 to 60 minutes. The curd is then gently cut with knives both across and lengthways, and subsequently with a curd knife with several horizontal blades, these dividing the already cut curd into cubes. The blades of the knife first used are vertical. The temperature is then raised a few degrees and the curd is further broken up, care being used to prevent bruising the curd and extracting the fat from it. The extra heat hardens the cut curds, and finally they yield up most of their whey. A strainer funnel is then fixed in the bottom of the vat and the whey is run off, passing by a tube or tin gutter into the whey tank near at hand. The curd now packs on the floor of the vat, but it is cut into large pieces and then piled on a drainer and covered to maintain the temperature, and thus promote the development of acidity. The system of different makers, however, varies considerably. When properly ripe it is cut into blocks and finally passed through a mill, after which it is salted and put into moulds, in which it is pressed for a few days. The cheese is then bound in cloths and sent up into the cheese-room. The implements required in cheese-making are vats on wheels for large cheeses, which can be run from room to room, and wooden tubs for small cheeses. Moulds of metal pierced with

holes, and of wood which open at the sides and fasten by screws, are necessary. For hard cheese, presses are also required. Those which hold two cheeses each, and which permit of one being removed without disturbing the other, are preferable. The best curd mills are those which do not tear or bruise the curd. It is also necessary to have strainers, and in large dairies, steam, as well for washing up as for heating the milk and maintaining the temperature of the cheese-rooms, which is most important.

There are different implements required for every branch of cheese-making, but space forbids description. In making soft cheese, however, and we believe this to be specially adapted to British dairy-farming, the implements necessary, although numerous, are not expensive. The working rooms must be maintained at from 58 to 63 degrees. The tables must be made slightly aslant for draining the curd, and provided with gutters to carry off the whey. The chief requirements are wooden vats to hold eight gallons of milk, straw mats, beech boards upon which to lay them, and metal moulds of various descriptions. With these implements and a knowledge of any particular system, almost any one of the popular continental cheeses can be made, the difference in manufacture being simply in the quality of the milk, the temperature at which it is set, the time at which the curd is brought, the condition of the curd, and the fungus or ferment which the cheese attracts, certain leading cheeses being attacked by particular fungi, which appear to work the requisite change by converting them from raw curd into cheese.



CAMEMBERT CHEESE DAIRY.

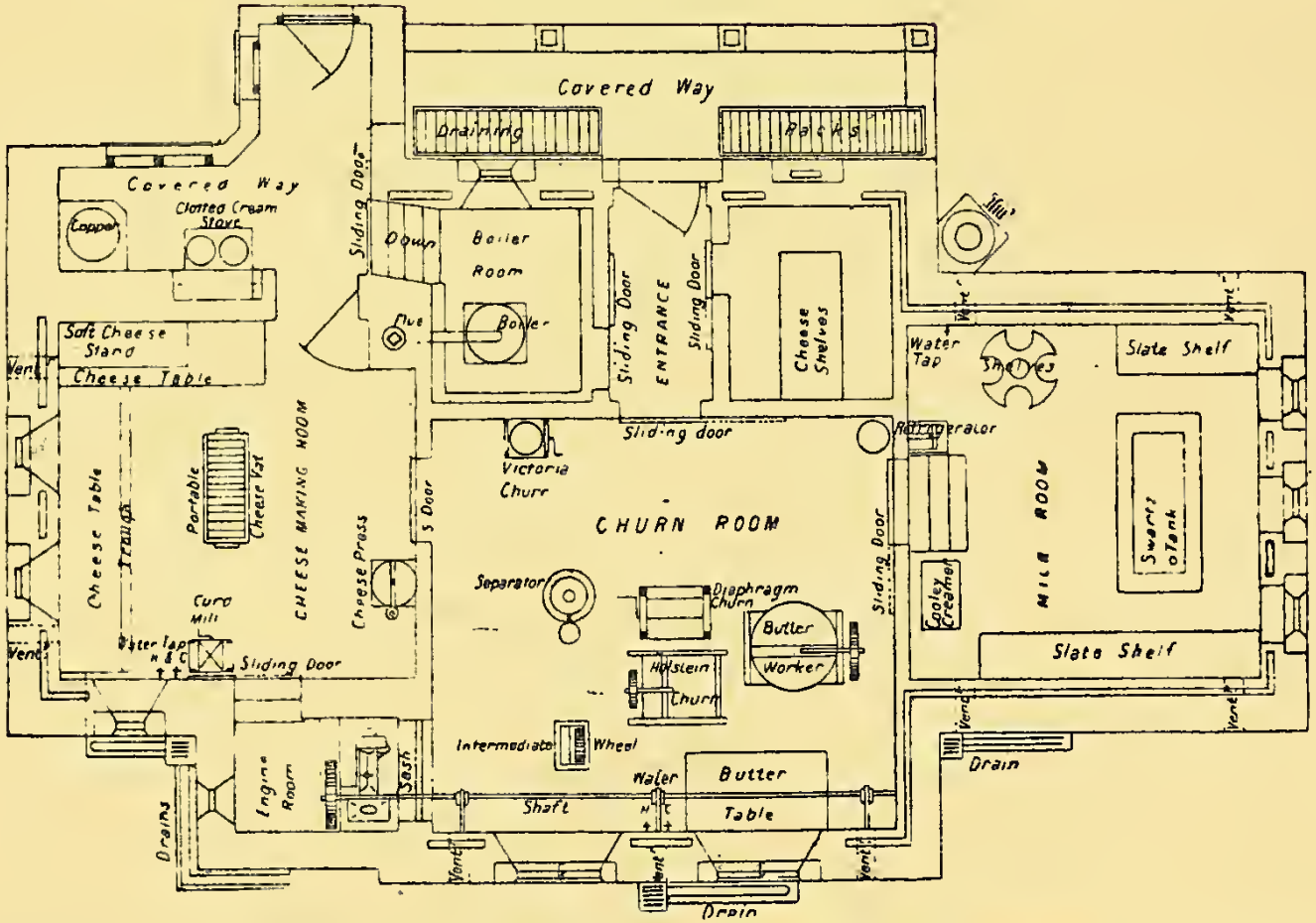
[*To face p.* 28.

The Camembert on the one hand, and the Gorgonzola on the other, appear to us to be specially adapted to the southern dairy-farmers, both requiring good milk and a warmer temperature than can be obtained in most parts of England. These varieties we have both made and taught others to make with perfect success, the produce being quite equal to that sent to England by the foreigner. In making hard cheese, such as Cheddar, one gallon of milk is generally supposed to make a pound. The ordinary price of cheese is about 55s. the cwt. of 120 lbs.—65s. is a good price, and 70s. a high price. If, however, 60s. is maintained, it returns 6d. per gallon for the milk. To this is added the value of the whey, which yields a certain amount of butter, the average being about one pound per cow per week. The residue, which is fed to pigs, is valued at 20s. per cow per annum. In a dairy where $4\frac{1}{2}$ cwt. of cheese is made per cow per annum, 540 gallons of milk at least must be yielded; but in some dairies 650 gallons are produced per cow, the balance being sold at a high price in the worst winter months, or made into butter. In this way, when cheese is well sold and the whey-butter made from sweet instead of sour whey, a large return is made. In some instances, known to the writer, the returns have reached from £22 to £23 per cow, extending over 100 cows. To obtain such a yield the cows are extra fed in summer upon cotton-cake and meal, and high wages are paid to the dairy-maid in order that the best article may invariably be produced.

In a cheese dairy of large magnitude the cows should,

as far as possible, be bred and fed for a large percentage of solids. There is considerable outlay for the labour of milkers, but less than usual for labour upon the farm, the majority of the acreage being in grass. An inferior cheese-dairy, like an inferior butter-dairy, cannot prove profitable. Where the work is well done the business is decidedly lucrative. If this is so with hard cheese, it is evident that it must be still more so with soft cheese, as, in consequence of the greater quantity of water remaining in the curd, the soft cheese not being pressed, a greater weight of cheese is produced.

In "British Dairy Farming" we have given more complete details for the manufacture of every important variety of cheese, together with illustrations of the implements used.



PLAN OF THE DAIRY AT THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

[*To face p.* 30.

CREAMERIES AND FACTORIES.

THERE are two systems in dairying which may be termed co-operative—the factory and the creamery—although they are as often proprietary as they are co-operative. In the case of the factory, the farmer is either a shareholder, taking his share of the net receipts in proportion to the milk he sends, or he sells outright to the factory owner, who pays him so much a gallon when his milk reaches a certain standard. In the factory, milk can be made up into any kind of cheese, or into butter; or it can be, as it often is, sold in its pure state. The factory man possesses a number of means of disposing of his produce, but in the creamery system there is practically only one. The plans adopted in the creamery are two. In one case the cream is collected and paid for according to its weight or measure, in which case satisfaction is seldom given, as the various creams present a variety of qualities; whereas, in the other, a farmer delivers the cream, which is churned for him and made up into butter, and he is paid in accordance with its yield minus an

allowance for working expenses. In this case the creamery becomes the farmer's auxiliary. It does his dairy-work and markets his produce for him, than which there can be no more undesirable system.

Having churned each farmer's cream separately, it is true the creamery is able to mix or blend it together and send it out as of one quality. The farmer could not fail to do equally well for himself if he took the trouble to make good butter, and market this to the best advantage. In the creamery the butter-milk is either returned to the producer at a small price per gallon, given to pigs, or sold outright, but in neither case does it receive its due attention. To be more successful, the creamery should deal more advantageously with skim-milk. If, however, it be necessary to the farmer that a portion of his dairy-work should be performed for him, there is no reason why he should not deliver the milk itself that it may be separated, causing him still less trouble and expense.

In the factory, cream separators are always used for work on a large scale. The cream and skim-milk are conducted from them into separate tanks, and both can be cooled or heated at will. The cream is ripened and churned the day after separating, steam power being used both for churning and working. The butter is generally made up with rapidity and sent out the same day. The milk is weighed on receipt and credited to the farmer's account, and great accuracy is observed in ascertaining the quantity of milk required to make a given quantity of butter or cheese, as on this basis depends the price paid to the farmer. The farms are

occasionally inspected, and the milk is regularly tested by analysis that the standard may be maintained. Factories are of great advantage in outlying districts where milk is cheap, and they will be a still greater medium in fighting the foreign producer, because by their aid only can uniformity in quality be maintained. If, however, a particular district or county, like Somerset or Devon, desires to emulate the fame of Norman and Danish butter, it might be preferable to organize a system by which good butter could be regularly bought up and blended together in accordance with their various qualities and colours. This blending is the sole secret of the French trade; for quality alone, good as it is, would not enable the Norman farmers to send us such a uniform article as they do.

In a co-operative factory it is necessary that the milk should be converted into butter at a cost of no more than a penny per pound; that the milk should be rich, one pound of butter being made from 2½ gallons at the outside; and that the butter should fetch a summer price of at least 1s. 2d. per lb. Under these circumstances, if the skim-milk is sold at 2d. the gallon, as it ought to be at least, the members should receive 6½d. to 7d. per gallon for the milk they deliver; but as factory milk is seldom equal to this in quality, as it often costs more to make it up into butter, and as the butter sometimes realises no more than 1s. per pound, the farmers receive from 4¾d. to 5¼d. per gallon. With regard to cheese, there is less variation in the proportion of cheese to milk, and, estimating one pound to the gallon of milk made at the cost of a half-penny,

the members would rceeive from 4½d. to 5½d. the gallon only, factory cheese seldom being of a high quality, or, if better than usual, seldom selling at so high a price as cheese made by private persons; the value of the whey and the whey-butter does not much affect the price paid for the milk. There is, however, a grcater chance of success when the factory is managed by an individual who is an accomplished dairyman, and who, working for himself, is careful that the milk he buys is of a high quality, and that he makes only to suit the markets.

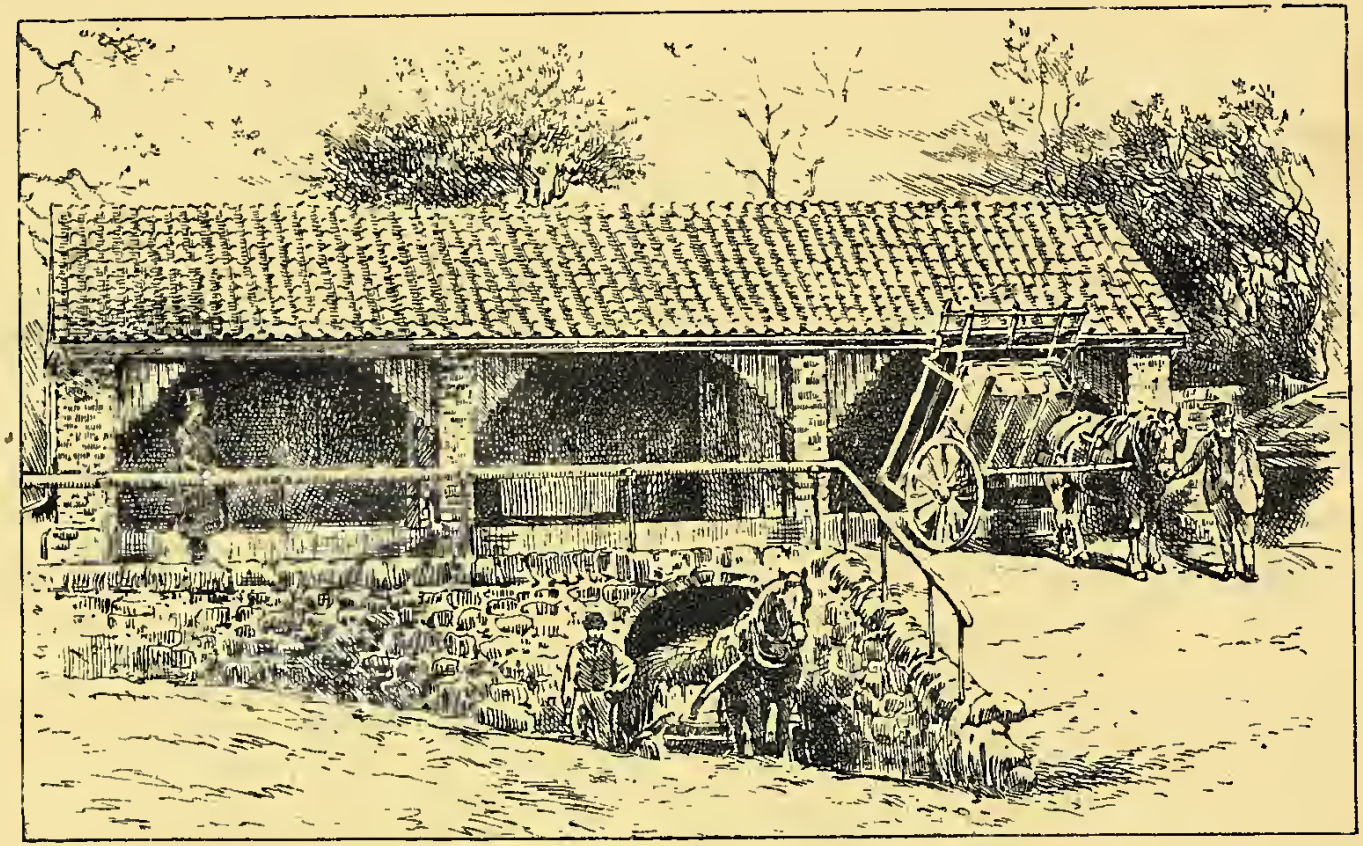
The factory manager should be able to convert his milk into any well-known dairy product, and to thus avail himself of every advantage as it presents itself; but co-operative factories, under the management of farmers who are either butter or cheese makers, seldom or nevcr venture beyond one of these two foods, and they are therefore obliged to accept such money payment for their milk as cheese and butter return. Compared with the creamery, we believe the factory to be a succcss; but comparing the factory with the butter-blending house, the result is much in favour of the latter if the success of the French is any guide. We have, however, greater faith in home dairying, believing that the very highest type of dairy produce is made on the farm.

ENSILAGE.

Good silage is a valuable and cheap food for dairy cattle when it is sweet, or when it contains so little acid that its odour is not objectionable. Too much acid in silage is deleterious to the health of the cattle; but were it not so, the odour in connection with it is such that it ought not to come into contact with such an absorbent fluid as milk. Milking cattle generally thrive when they receive a fair quantity of succulent food, such as silage. It is, practically speaking, a food naturally mixed with water, and is therefore much superior to ordinary dry foods which are artificially mixed with water in the process of feeding. Silage is not only a cheap and succulent food, but it can be made when hay cannot. It has been observed that silage-making may be conducted independently of the weather; but this is not the case, inasmuch as an overplus of water in or upon the plant prevents a proper fermentation, and causes the silage to putrefy or spoil. The greatest advantage in the system is that it enables the farmer to grow a larger acreage of

forage crops and catch crops, such as tares, trifolium, lucerne, rye, and maize, all of which yield heavily, and are valuable for milk production, but which cannot at all times be made into hay, and which, therefore, are not cultivated beyond the consuming power of the farm when they are in their green state.

It has been shown by experiment that 50 lbs. of good silage is equal to 84 lbs. of mangels; therefore, an acre yielding 10 tons of silage, especially if it be made from forage grass, is equal to an acre of average swedes or mangels, although the latter cost three times as much to produce. For cows, silage should be moderately sweet, and to obtain this condition it should be put into the silo after being exposed to the air for a few hours, so that a portion of the moisture may be evaporated. Compared with hay it is, if well got, undoubtedly more digestible, although a larger portion of its feeding constituents are lost in fermentation. Silage will not and should not supplant roots upon the dairy farm, whatever their respective value, as both are necessary to success—especially the roots in the rotation system. In ascertaining the feeding value of silage by experiment in comparison with other foods, it is always necessary to ascertain its quality—not only the value of the grass from which it is made, but how much water it contains. An average sample contains 70 per cent. of water, but as some silage contains as little as 55 per cent., it is evident that a sample of this might be 50 per cent. more valuable than the average sample, containing, as it does, 45 per cent. of solids as against 30 per cent.



THE ROYAL AGRICULTURAL SOCIETY'S CHAMPION PRIZE SILO.

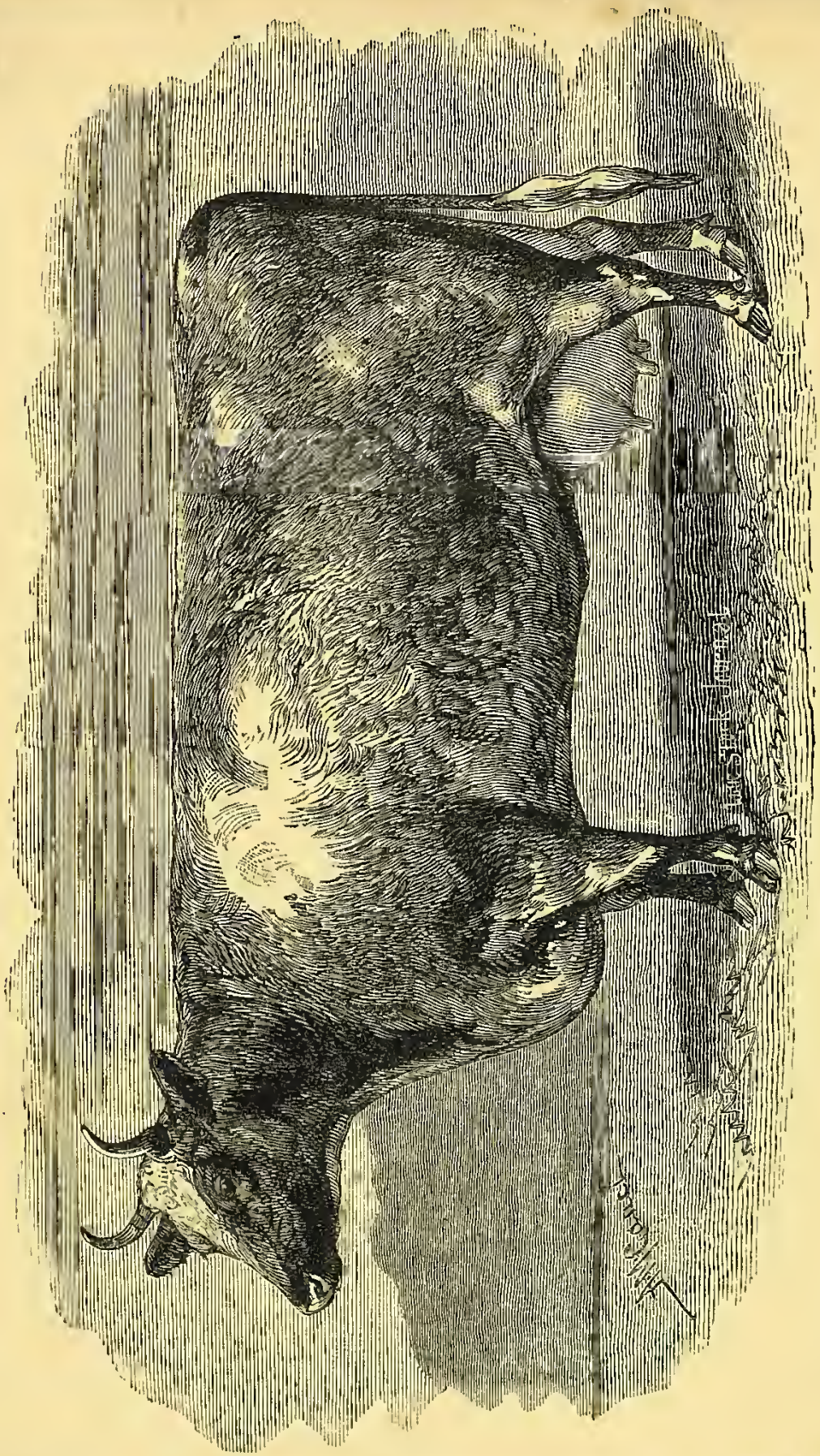
The pits in the three bays are filled from above and emptied from below. When full and covered with planks, the building can be used as a shed or barn.

[*To face p.* 37.

Grass for silage should be cut at the commencement of ripening and while still succulent, but if possible in dry weather. If cut before, the stem is not fit, as, the cells not being matured, it is unable to resist the fungus which causes it to ferment, and it putrefies in the silo. If cut too late, it is of far less value by reason of the conversion of a portion of its feeding matter into indigestible fibre. Grass which has been over-dried before pitting is liable to mildew, a portion of the cells having been destroyed or killed. Mildew also appears when the air is admitted to over-heated silage. The silo should be water-tight and air-tight, the apartment being built, if possible, in the end of a barn or similar building on the side of a hill, with a door below inside the barn for removing the silage, and a door in the building at the top through which it may be filled from the high ground outside.

An entirely overground silo is difficult to fill, as the grass must be elevated, whereas if entirely underground it is difficult to empty as well as being costly to make. With considerable experience of silos and silage, we believe the best silo of all to be that made by running a 14-inch wall across the end of a brick or stone-built barn—the entire inside of the walls being faced with cement. The floor may be concrete or beaten earth. When filled and well trodden on the outside, the grass should be covered with 18 inches of moist earth raised by barrows and pulleys. The labour looks formidable, but it is not difficult; two men, a horse, and a boy being able to cover a large silo in a single day. It is preferable that the earth should lie directly on the

grass, that it may follow the unevenness of the surface in sinking, but it should be trodden down from time to time where cracks appear. When the silage is cut, the earth is thrown back from above the door, and a cut is then taken down to the door; after this both earth and silage can be removed outside with the greatest ease. It may be mentioned that the larger the silo the less is the proportionate loss at the outsides and corners, which should always be rounded. Where stone, brick, or iron is used for weighting, 100 lbs. to the square foot will be found sufficient, but neither are equal to earth. Stacks, although a few have been successful, are not equal to silos, the waste being much greater. They have, however, brought out good systems of pressure by means of ropes and jacks, which are most effectual; but we believe that there is no system of pressure, elaborate or simple, which is as effectual in keeping out the air as earth, and we are borne out in this belief by our experience in acting as a judge of silage for the Ensilage Society, and of silos and stacks for the Royal Agricultural Society of England.



SHORTHORN DAIRY COW (Champion Prize London Dairy Show, 1887).

[*To face p.* 39.

CATTLE.

It matters little in what part of England we discuss the question of dairy cattle, we find in almost all cases the Short-horn has the majority of friends, and yet practical experience shows that as a dairy breed it has some inherent faults, and that there are many instances in which its suitability is not so great as that of other varieties. To thoroughly understand the Short-horn as a milking-cow, we must consider it both as a pedigree and as a milk-producing beast. The pedigree has little influence for good upon milk production; whereas if breeding stock were selected with great care from the best milking strains, such herds might be produced as could not be excelled in any country. Deficient, however, as the pedigree Short-horn is as a milker, the selected Dairy Short-horn deserves the highest praise. The problem among Short-horn dairy farmers is to ascertain which pays them the better of the two systems—the purchase of useful cows which are medium milkers, and which can be fattened gradually, as they decline in their milk yield, for con-

sumption as beef; or the breeding of the best type of deep milkers, without so much regard to meat-making capacity.

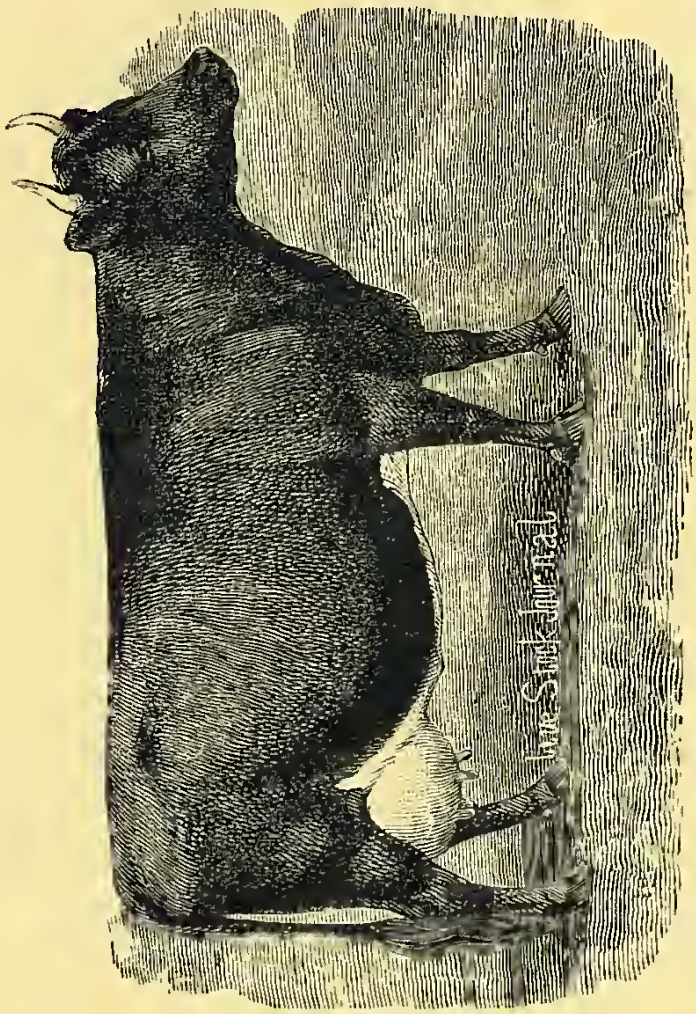
Unhappily, a direct answer can scarcely be given as to the better plan of the two, for nature steps in to prevent it, through the difficulty constantly experienced by owners of Short-horns in getting calves from a large percentage of their cows. We have no hesitation in believing that were this difficulty overcome, the majority of the big Short-horn owners who keep their cows for milk would prefer to breed more extensively, and to give greater attention to the selection of milkers than they do at the present time. This is the difficulty which causes so many men to rely upon purchasing rather than upon breeding. We believe that if milking cows were kept under less artificial conditions, and if stockmen were more attentive in watching them, that there would be fewer cases of barrenness. Dairy cows, confined through the winter as they are for so many months, should be permitted to have exercise upon every eligible occasion, and not altogether with regard to the quantity of grass at their disposal. Fresh air and exercise are necessary to successful breeding, and this fact must not be lost sight of; but where cows are always tied up, or with very little exercise, they cannot be expected to breed more freely than cattle tied up in London cow-stalls. There is greater difficulty, too, in catching cows for service when they are tied up, and this is not altogether removed by merely letting them out for a few minutes to drink once or twice daily.

Dairy Short-horns can be purchased in Yorkshire, Lancashire, Cheshire, and Bucks of a very high milking type, and no difficulty is experienced in finding cows which yield 20 quarts daily through the greater part of the summer. Many of these cows, too, are rich milkers; but in purchasing from a distant county much expense and trouble is experienced, not only at the outset, but in maintaining the character of the herd; and for this reason, perhaps, more than any other, a breeder or cowkeeper may find it answer his purpose better to keep the variety of cattle which is almost at his door. Where, however, Short-horns are kept, we believe that they are less improved than they might be, on account of the use of bulls of beef-making pedigree rather than of those which have a distinct line though a race of heavy milking cattle.

The Devon, like the Short-horn, is bred in two distinct fashons—for beef and for milk. In Somerset, as well as in parts of Dorset, where dairying is extensively carried on, there are large herds of Devons of good frame and milking character, which yield a fair average quantity of milk of high quality. The action of a public body, determined to carry out a definite plan, might immensely improve these cattle by offering prizes for the best milking Devons, quantity as well as quality of milk being taken into consideration. If we compare this class of cow with the ordinary class of Short-horns, very little difference would be found in their respective yields of milk food. For example, a Short-horn yielding 20 quarts a day, or, say, 50 lbs., which gave 12 per cent. of solids with 2 per cent. of

fat, would return 6 lbs. of solids, of which 1½ lbs. would be fat. This is the real way to value milk rather than by its bulk. On the other hand, a Devon giving an average, during her best weeks, of 16 quarts a day, or 40 lbs. of milk, containing 13½ per cent. of solids and 4 per cent. of fat, would return 5 lbs. 6½ oz. of solids, and 1 lb. 9½ oz. of fat, or actually more than was given by the Short-horn. As a breed the Devon is superior as a butter-maker, although neither so deep a milker nor so valuable an all-round beast as the best type of dairy Short-horn; therefore the butter-making farmer in the West will not only find it advantageous to keep this variety in preference to the Short-horn; but, as it is the breed with which he is better acquainted, as it is near at hand, less costly to keep as well as to buy, and probably more suitable to the district, it will return him more money in the course of the year, and will, therefore, be better worth his while to cultivate.

There are two other breeds which are becoming famous in England, as they are in their respective countries, and which could be kept with great advantage upon the poorer and bleaker lands of many counties—the Ayrshire and the Kerry. These breeds are both hardy, and thrive upon poor pasture. They are not butter-makers of high value, but they are heavy milkers, especially when we consider their size, the Ayshire being a little larger than the Jersey, and the Kerry very much smaller than either. Both cows, however, yield a large percentage of solids, so that their milk is well adapted for cheese-making. The milk



KERRY COW.

[*To face p.* 42.

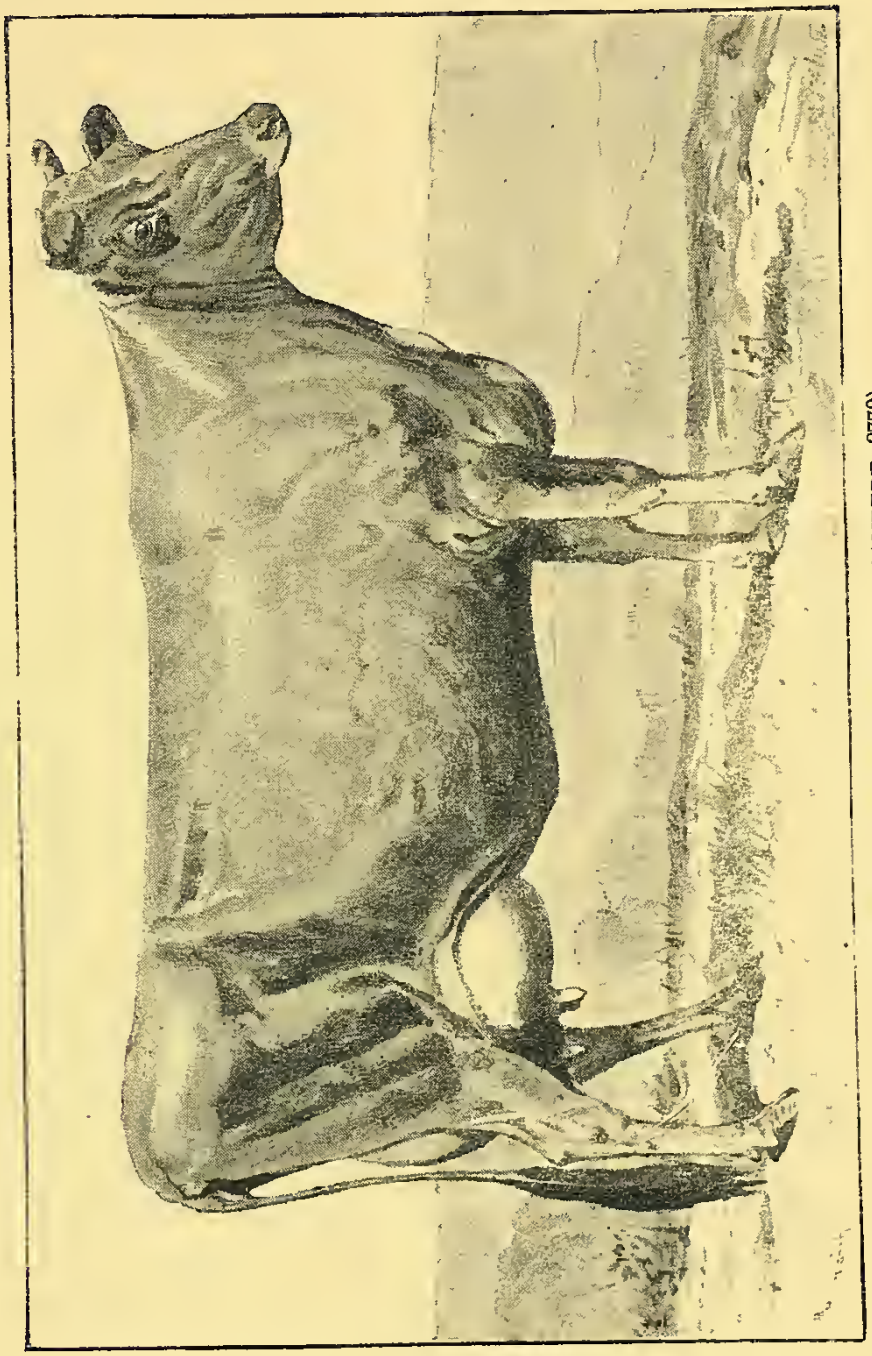
however, has this disadvantage—that it is extremely white in colour. Both breeds are cheap to buy, and easy to rear. They have not the advantages of the Devon or the Short-horn as beef cows, and when accidents happen, or when they are dry and barren, they are sold at a proportionately less price; at the same time they can be brought into fleshy condition by good feeding, and are much superior for beef production to the Jersey or Guernsey. We are of opinion that these breeds might be utilized in the manufacture of some of the leading foreign cheeses of large size, such as Gorgonzola, Parmesan, and Gruyère, all of which are popular in England, and are largely imported. We have less hesitation in making this suggestion, having learned the system of manufacture in the countries in which they are made. In neither case is extra rich milk required; but, setting fat on one side, the greater the quantity of the total solids of the milk, the more profitable will the cheese industry prove. The Ayrshires are purchasable at from £14 to £16 in Scotland, very useful cattle being obtained at these prices, and, despatched by the truck, the cost of carriage is not very great. The Kerry costs £6 to £10 in the South of Ireland. Both varieties, in addition to their thriving upon poorer foods than other cattle, are satisfied with a much smaller quantity. Three Ayrshires can certainly be kept for the cost of two Short-horns, and probably five Kerrys can be kept for the cost of three Short-horns. Both breeds resemble in their character and their milk-yield the cattle found upon

the Alps, which are kept in small numbers by the numerous peasants who carry their milk daily, in quantities of from 1 to 10 or 20 gallons, to the farmer or co-operative factory, where it is made into Gruyère cheese.

The Red Poll is too valuable a breed to omit. It is not unlike the Devon in either colour or character. It also is divided into two classes, one of which is bred for beef and the other for milk. It is the speciality of the Eastern counties, just as the Devon is of the South West.

There are certainly no cows in this country which excel the Devon for richness of milk but the Jersey and Guernsey—the one a fawn-coloured cow with shades of grey, mulberry, and orange, and the other a yellow and white cow. These varieties are so largely bred for exhibition and pure fancy that they have not always had their just due; but where bred essentially for the dairy, and treated as ordinary cattle, they become larger, more vigorous, and better producers of milk. They are essentially butter-makers, their milk and cream being of high quality as well as of high colour. These breeds are superior to any for cream-cheese-making. Although their average yield of milk is not great, yet for the above reasons, and because the solids their milk contains are very high, they will compare favourably with almost any cows which are known.

Comparing the Jersey with the ordinary dairy cow averaging 8 quarts a day for the milking year, or about 600 gallons, we shall find that 8 quarts, or 20 lbs. of milk, contain 12 per cent. solids with 3 per cent. of



JERSEY COW (MARY ANNE OF ST. LAMBERT, 9770).

[*To face p.* 44.

fat, yielding, on the part of the ordinary cow, $2\frac{1}{2}$ lbs. of solids and $9\frac{3}{4}$ oz. of butter fat daily. On the other hand, a Jersey averaging 6 quarts, or 15 lbs., of milk a day for her milking year, the milk containing 14 per cent. of solids with $4\frac{1}{2}$ per cent. of butter fat, will return 2 lbs. $1\frac{1}{2}$ oz. of solids and $10\frac{3}{4}$ oz. of butter fat. This suggests that a Jersey not only yields a higher profit as a butter-maker, but costs less to keep. It is true that she is worth little when dry or barren; but this fact is met by another, that the Jersey is one of the longest of milkers between calvings, and she is superlatively a cow which maintains a rich flow of milk for the greatest number of years.

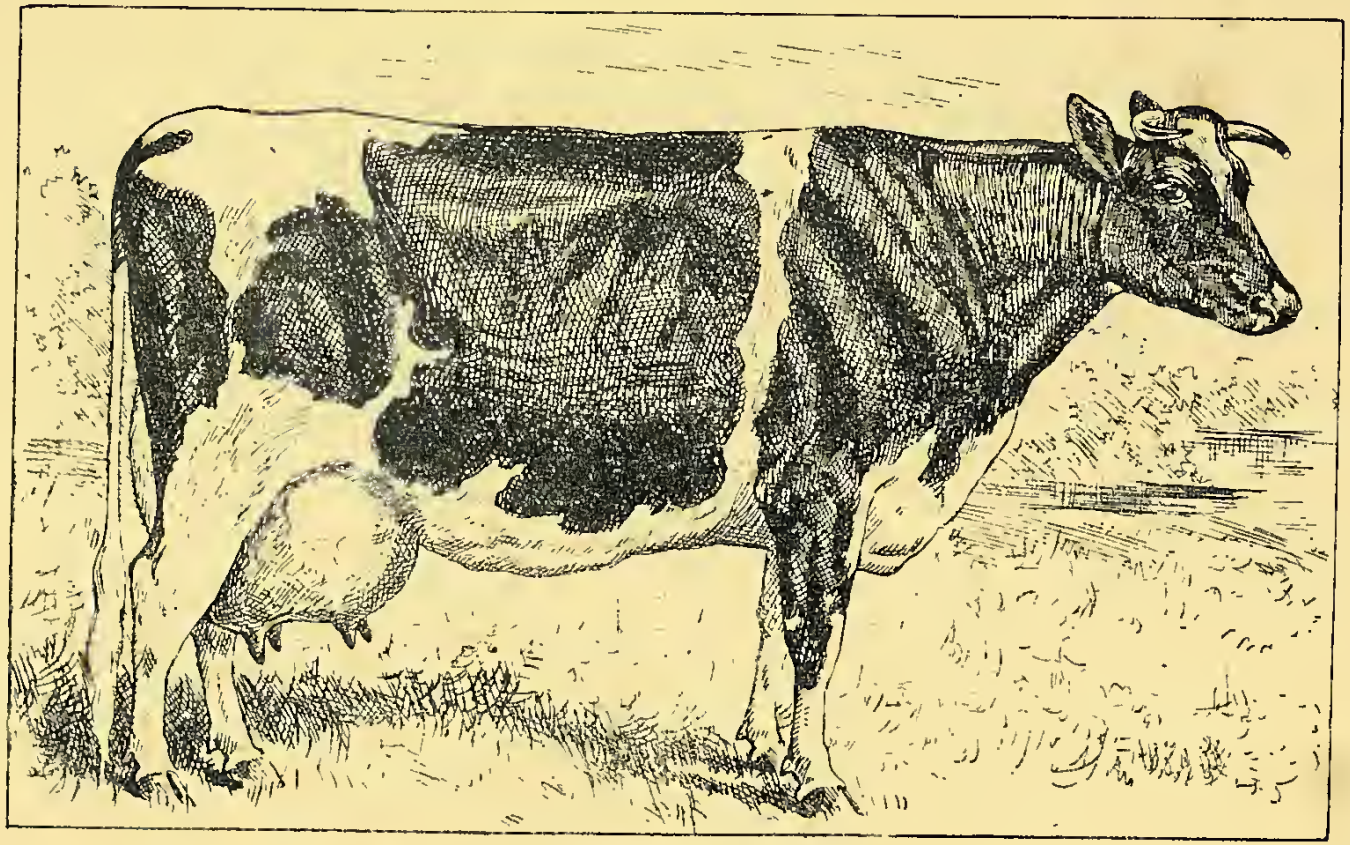
MANAGEMENT OF THE COWS.

THERE is no building upon the farm which is erected in so many different ways as the cow-house, and yet it should be, for the sake of the animals, as perfect and comfortable as possible. Next to the comfort of the cows, one of the principal things is to provide for the saving of litter, especially in grass-producing districts. To this end the most perfect plan is that adopted by the farmers of North Holland. The cow-standing is from 4½ ft. to 6 ft. in length, according to the breed of the cow. It is of beaten earth, with a curb of 9 inches of cemented brickwork at the heels. Here is a gutter 9 inches deep by a foot wide, and behind this is a passage. The gutter is quite square, and if the standing is of a proper length almost all the manure, liquid and solid, will fall into it, the liquid being carried off by a pipe which runs direct into the liquid manure-tank, which should be under the centre of the manure heap in the yard, the liquid from the heap itself draining into this tank. The manger should be made of Staffordshire ware of semi-circular form, running the

length of the cow-house and raised only from 4 to 6 inches above the floor. In this way room is given to the cow who lies with her head over the manger when at rest. If a high manger is adopted, the animal cannot do this, but requires a proportionately longer standing. In this case she drops her manure upon the standing itself, rendering straw necessary.

Whether the cows are watered in the house or not, a tap should be at one end of the manger and an overflow pipe at the other, so that by turning on the tap the manger can be washed out at will. Where cows stand head to head, overhead should be a rack of V form; or if their heads are next to a wall, the rack should be of a suitable shape. This is for the hay, the seeds and short portions of which will fall into the manger. Between each pair of cows should be a short and strong partition, and on each side of this a short iron rod should be so fixed that the ring attached to the cow-chain can slide up and down. Each cow should be so chained that she cannot reach her neighbour. Where cows are kept head to head with a passage between, this, like the passage behind the animals, should be sufficiently wide and level to run a truck, barrow, or tram-car for the removal of the manure or the conveyance of food, both plans being simple and economical. The food-barrow should run direct from the mixing floor, and the manure-barrow to the manure heap outside, which, if possible, should be upon lower ground. Where this is the case, a plank or a pair of rails can be extended a few yards and the car emptied in a moment.

Another plan is to wheel the dung in a barrow along a plank direct into the dung-cart. In this case the dung can be at once carted into the field where it is to be used, or under a covered shed. The mixing floor should always be near the cow-house and made of concrete, with divisions arranged so that each food can be kept separate before mixing. If an engine is used this should be placed so as to work the pulper, cake-breaker, chaff-cutter, and grinding mill with economy and ease. The chaff machine should deliver into its own apartment, and the same may be said of the pulper, the roots thus being shot into the shed adjoining. It may be more convenient for the cake-breaker and grinding mill to be on the floor above. In any case there should be no labour lost in placing the produce ready for mixing. If ensilage is used, it also should be conveniently near, and delivered ready chaffed for mixing. Winter rations, however they may be composed, if of partially dry food, should be prepared sufficiently long before use that they may heat, a slight fermentation causing them to be both warmer and easier of digestion. Where a steam boiler is used daily it is a good plan to provide a tank—an old ships' tank will do very well—or a brick and cement bin, to steam the food for use. This is an easy and economical plan, and it is only by the adoption of practical methods such as these that the dairy farmer can compete with the foreign producer. The cow-house should be high, well lighted, and well ventilated. Light may not be so necessary to the cattle, but it certainly is to the master. Calving boxes should be sufficiently near, so



A MODEL DUTCH COW.

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that the down-calving cows may be within easy reach both of the cow-man, of food, and of the manure truck. They should be enclosed, dry and warm. Warmth is not actually necessary to milking-cows if they get plenty of exercise, as they should do, but on no consideration must they be subjected to draught or drifting rain.

The calf-pens are better out of sight of the cows. These also should be roomy, light and dry, the calves being kept loose with sufficient boxes—preferably of hardware—to contain their food. It is the practice to keep a bull tied up, and, for the sake of human life, bulls ought always to be kept either on the chain or the staff. For successful breeding, however, the bull should have a certain amount of liberty. This is best obtained by giving him a yard of fair extent, which should be strongly fenced; or he may be taken to exercise daily on the staff by his attendant. Bulls should not be too highly fed upon dry food. In summer plenty of green food is all they require, and in winter hay and roots, unless they are severely worked. There are few conditions under which a healthy bull requires artificial food.

As a rule, calving takes place between January and May, but it is worth the while of the dairy farmer to consider whether it will not pay him better to calve some or all of his cows in October and November. Winter milk will frequently pay ten-pence a gallon, where summer milk pays only sixpence. The question resolves itself more into the facilities which a man possesses, and he can work out for himself the

relative cost of his summer and winter feeding. If, by producing winter milk, after allowing sufficient margin for the extra cost of feeding, he can make more money, it would be wise to do so, one reason being that summer production is gradually getting too extensive, especially as regards milk-selling.

Cows for calving should not be milked within at least six weeks of calving, and where there is any suspicion of milk fever, they are better turned upon poor pasture and their rations reduced by degrees. A full-fleshed cow should always be carefully watched, and there is no better plan than to administer good doses of Epsom salts two and four days respectively before the day of calving. Ordinary Jerseys are seldom troubled with milk fever or calving complaints, and may get 2 lbs. of bran daily right up to calving, after which their ration will be increased. Cotton-cake is one of the most valuable of milk-producing foods, and may be given on pasture at the rate of from 2 lbs. to 4 lbs. per cow through the summer, with advantage to the animal as well as to the land. In breeding, it will be found a good practice to put heifers to the bull at 18 to 24 months, although with the Jersey variety they may calve at two years without harm. This is a common practice in the Island, and we have carried it out with success, never finding any ill results. A heifer should never be discarded because she milks badly with her first calf, nor a cow because her yield is only of medium quantity if the milk be rich. Some of the most money-getting cows are those which yield a comparatively small quantity of

rich milk, and these animals will often produce 6 lbs. of butter per week as they approach the time for calving again.

The rearing of calves is not undertaken by all dairy farmers, but when carried out with skill, it is a profitable proceeding. Calves cannot be reared on new milk with profit. It is too costly a food. The easiest way is to allow a calf to suck its dam until it can feed, but this plan should never be adopted. There are two practical methods of succeeding—one is to wean a calf at birth, never letting it take the milk from its dam at all, but teaching it to suck an india-rubber teat fixed to the feeding pail. When this habit is learned, the milk can be gradually changed from new to skim milk, and gruel made of linseed meal, or, what is perhaps preferable—if a separator of the Danish type is used—the separated milk can be mixed with a small quantity of linseed oil equal in weight to the fat taken from the milk. This milk, revolving in the machine, forms an emulsion, which can be diluted with warm skim milk, and given to the calves. The principle is similar to that of adding suet to skim milk for consumption by children. The other plan is to wean the calf at the end of fourteen days and to teach it to drink from the pail. The milk in this way can be similarly changed to gruel made of linseed and milk, or to milk and oil as before. Space is not sufficient to give details of the work of feeding calves; indeed, details of this practical nature, it may be assumed, are understood by farmers in general. There is much to be said in favour of autumn calves, inasmuch as, having been well cared

for during the winter, they come on to pasture at a good age; but in the case of spring calves it is very questionable whether they should be put upon the pasture until the following year. When a calf is taken to grass it should still have plenty of dry food, such as hay, chaff mixed with bean meal, and linseed cake. Calves should always be well fed from birth. They should never be allowed to fall back in condition, especially in the case of the steers, for early maturity is a profitable thing to consider. The object should be to bring them to the butcher as soon as possible; but the heifers may be fed less liberally during their second winter, getting hay, straw chaff, and roots, with just a little cake.

The work in the cow-house should be conducted by clean men, who should be required to wash before milking, and not to touch the milk with their fingers. They should not smoke, nor be allowed to milk without first washing the udder. In a large dairy the milkers should be under a foreman, whose duty it should be to weigh the milk. Strangely, while a farmer takes the greatest care to weigh his corn, he is content to measure the more valuable milk he produces. Each man should daily groom the cows under his charge. Well-groomed animals frequently sell themselves, and they are always more comfortable and must therefore produce more milk. On breeding-farms every beast should, soon after calving, be marked with a numbered ear-button. If a herd-book is kept the number will give the reference to the breeding of the animal.

With regard to the profits per cow of the Devon

dairy breed, such as we have seen in great numbers in the three Western Counties, we believe that 500 gallons of milk per year would return, if the work were thoroughly done, at least 220 lbs. of butter, then :—

220 lbs. butter at 1s. 2d. - - =	£12	16	8
400 gallons of skim milk, sold or made into cheese, at 2½d.	4	3	4
	£17	0	0

Against this we have the cost of the maintenance of the animal. Assuming that she cost an average of 1s. a day for food for the seven winter months, and 35s. during the five summer months, the result would be as follows :—

210 days at 1s. - - - - - -	£10	10	0
155 days - - - - - - - - -	1	15	0
Labour and other charges per cow	2	1	0
	£14	6	0

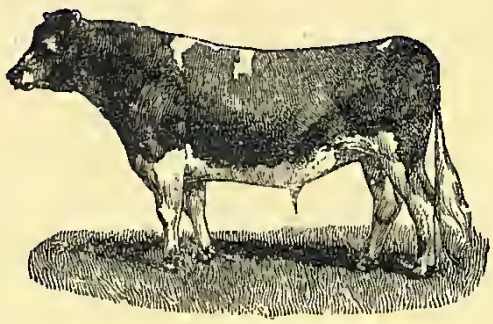
The summer charge is based upon the belief that one cow can be kept upon an acre of good grass worth 30s. an acre, or 35s. including charges. If this is not done, it ought to be. The cost for labour is based upon the common practice of some of our very ablest dairymen, who pay 1s. per week per cow when housed; the milking, mixing, and feeding as well as the cleansing out of the cow-house being included. This sum is charged for the winter months, sixpence a week being allowed for the summer months when the animals are at grass. This expenditure is certainly not exceeded in many of the best dairies in Cheshire, but these

farmers certainly do exceed the receipts given above, where they make especially fine cheese. The balance of 54s. is left to provide a profit, as well as some extraneous charges which could scarcely come under the head of the maintenance of the cow. This profit, however, does not include the value of the calf, of the butter-milk, of the produce used in the house, often considerable, and of the profit made upon the food, charged at 1s. a day, which food should be, as far as possible, grown upon the farm, and, as it were, sold to the cows. It is as much upon these items as upon the milk that is produced that the profit depends.

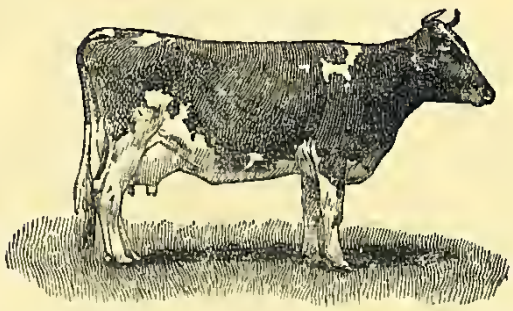
FEEDING.

It is necessary to understand, though in the simplest manner, that food has to perform various functions. It has to provide for the warmth of the body, by the process of combustion. This is a most useful and necessary function. It has also to provide for the formation of lean flesh and bone, and in the milking-cow it has to provide for the manufacture of milk. Fortunately foods, like milk, contain different ingredients. A considerable portion of coarse dry food is a tough fibrous material, which is indigestible. The bulk of green food is water. When the water is entirely removed the result is dry solids, a portion of which is digestible. These solids contain starch, sugar, and similar substances which act largely as fuel, fat which also acts as fuel and possesses other functions, and the substance which chemists call albuminoids, such as the fibrin of meat, the albumin of egg, and of blood. This provides the lean flesh of meat, and the casein of milk. The fat assists in providing the butter of milk, as well as the

fat of the beast—and the starch and sugar have also their share in the formation of the sugar of milk. Therefore, it is necessary that in the foods we use for stock these three materials should form a part. Chemists have shown in what proportion they should be given to animals, and especially to milking-cows, in order to provide for the maintenance of the body and the manufacture of milk. Some foods are known as nitrogenous foods. Among these are cotton-cake, beans, and peas; others are starchy and sugary foods, such as roots, potatoes, and maize. Others are well-balanced, like milk itself, and of these the principal green food is grass, and the principal dry food, oats. Straw-chaff, which is a heat-giving food, is given to satisfy the appetite of the cow, which requires quantity as well as quality. It has been shown by experts that the proper ration of a milking-cow should contain five parts of the heat-giving material to one part of the nitrogenous material; therefore, by referring to a table in which the composition of the various feeding stuffs is given, we can roughly estimate how to mix rations for our dairy cows to the best advantage. If a cow feeds entirely upon heat-giving foods, such as mangels, in order to extract a sufficiency of the nitrogenous material she must waste an enormous proportion of the heat-giving material; similar reasoning applies to all foods. Therefore, by carelessness in feeding, we may lose money to a large extent, for it is wrong to suppose that because a food passes into the cow's body it is necessarily utilised. A cow should not have fine meal given alone, because the arrangement of her



MR. T. BARHAM'S GUERNSEY BULL "CLIMAX."



MR. T. BARHAM'S GUERNSEY COW "LADY-BIRD."
(1st Prize in the Milking Competition, Dairy Show 1888.)

[*To face p.* 57.

stomach is such that it is liable to pass entirely through her without being fully digested, unless it is in conjunction with a coarse food. The quantity of dry solids a cow requires daily varies from 20 to 24 lbs. This contains the indigestible portion, as well as the digestible, but when the animal is eating a green ration she may be consuming more than one cwt. in order to obtain this amount. Hay, like grass, is one of the best of foods, but in most districts it is one of the dearest; first, because of its cost, and second, because so large a proportion is indigestible, that the animal must consume a considerable quantity to give a good return. At anything like market price, hay is the dearest of all foods for milk production. Straw may always form a portion of a ration with advantage. The best for this purpose is winter oat-straw, but it should be cooked, steamed, or fermented.

When cows are fed upon dry food they fail to digest about a quarter of what they consume; and in very cold weather, and when drinking ice-cold water, this loss is almost doubled, more food being required as fuel to heat this water, bulky as it generally is, to the temperature of the body. Where roots or silage is given there is less waste from non-digestion, and this waste is not increased when dry food which has been steamed is added. By using green crops for six or seven months, and this can be done with ease, cows can be much better fed, and their flow of milk stimulated at less cost than by any other system; indeed, there is no reason why, with green crops, cows should not have succulent food all the year, beginning with

green rye, vetches, trifolium, rye grass, and lucerne, and finishing with cabbages and roots. The following table will show the rations required for milking-cows and dry cows respectively. It is arranged for a cow of large size, say 1,000 lbs. weight. It is formed upon the basis that 15·4 lbs. of digestible dry food daily is sufficient to maintain the carcass of an animal of this description, and that every 1 pound of such food above this quantity is sufficient for the purpose of providing for a gallon of milk. Thus, 18·40 lbs. of digestible solid food, which is contained in about 29 or 30 lbs. of the dry matter of the usual foods, will enable a large cow to give three gallons of milk daily. An additional $1\frac{1}{4}$ lbs. of cotton-seed meal would be sufficient to provide for another gallon of milk. Such a daily ration (containing about $29\frac{1}{2}$ lbs. of total dry food) is the following, costing about 1s. $0\frac{1}{2}$d. :—

	Digestible.		
	Nitrogenous or flesh-forming food.	Fat.	Starch, sugar, &c., warmth-giving food.
$12\frac{1}{2}$ lbs. hay - -	·67	·12	5·10
35 „ swedes - -	·45	·03	3·71
$12\frac{1}{2}$ „ straw - -	·17	·10	5·00
5 „ cotton-seed meal	1·55	·60	·90
	2·84	·85	14·71
			18·40

The next ration is arranged for a cow of similar size which is dry and in store condition. It provides her with 22 lbs. to 23 lbs. of dry food daily, containing

14·40 lbs. of digestible substances, at a cost of 10¼d. It will be seen that the flesh-forming principle is nearly one-fifth in weight of the fat and heat-giving principle; but in estimating the fat it is doubled for this purpose, its value being about twice as much as that of the starch and sugar to which it is allied.

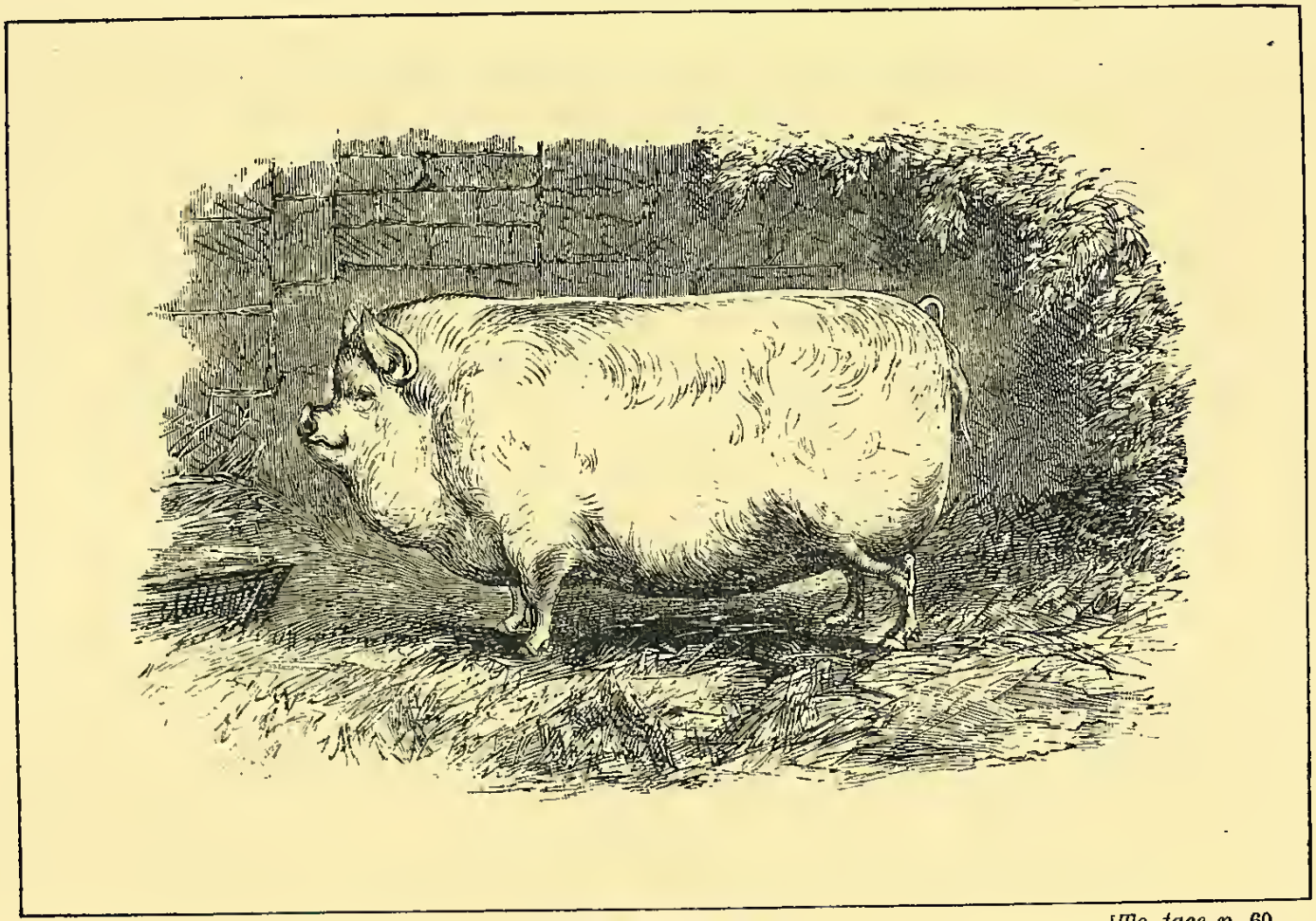
		Nitrogenous or flesh-forming food.	Fat.	Starch, sugar, &c., warmth-giving food.
6	lbs. hay - -	·33	·06	2·50
25	,, grains - -	·90	·20	2·70
12½	,, straw - -	·17	·10	5·00
4	,, cotton-seed meal	1·24	·48	·72
		2·64	·84	10·92
			14·40	

All these foods, but cotton-seed and grains, can be produced upon the farm, and estimating the value of hay at 70s. the ton, swedes 10s., and straw 40s., the daily cost of each cow is made up as follows :—

	Cost of milking-cow.	Cost of dry store cow.
	d.	d.
Hay - -	4½	2¼
Swedes - -	2	—
Straw - -	2½	2½
Cotton-seed meal	3½	3
Grains - -	—	2½
	1s. 0½d.	10¼d.

PIGS.

THERE are three methods of keeping pigs properly upon the dairy farm. The first is to fatten the larger kind of stock for bacon; the second is to produce pork; and the third, to breed and sell young pigs when they are weaned. Foreign competition has to a large extent destroyed the trade which was formerly done among bacon pigs, and it is now less profitable than formerly to feed for bacon upon the farm; indeed, except in special districts, this plan cannot be recommended in comparison with the other two. Where, however, bacon is produced, the Tamworth or Berkshire breed may be used, either pure or crossed upon a large-flanked local variety. The Tamworth in particular produces streaked meat, whereas the white and all the black breeds have generally too much fat. In producing pork, early maturity is very necessary; and to take advantage of this either the Berkshire or the white York pig should be used, both growing and fattening exceedingly fast upon a small quantity of food if they are of a thrifty stock. When 4s. 6d. can be obtained for a stone of 8lbs. with tolerable certainty, pork pays very well indeed; but no attempt

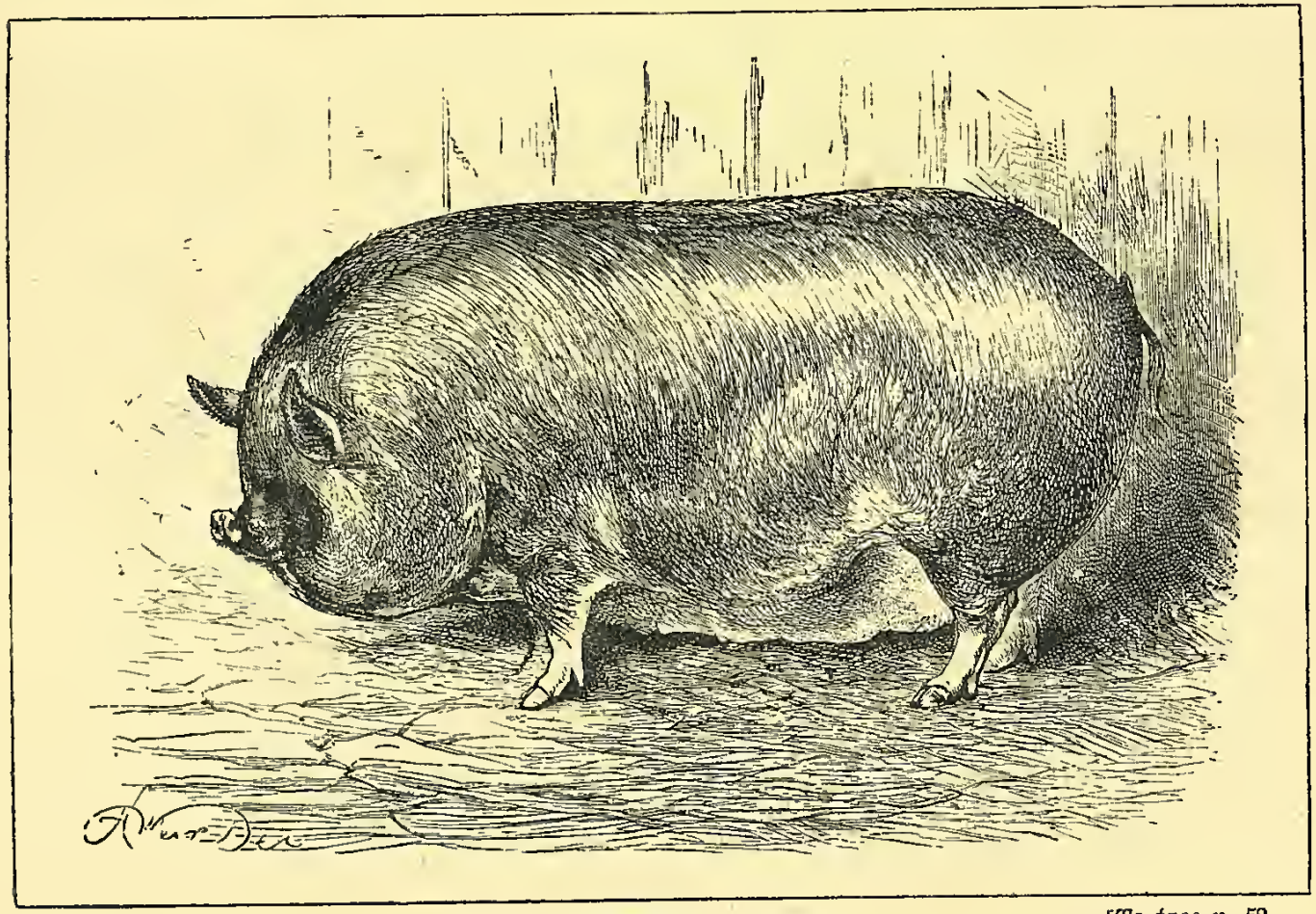


SMALL WHITE YORK SOW.

[*To face p.* 60.

should be made to produce it from mongrel pigs, although a first cross is not undesirable. In breeding to sell pigs when weaned, the same plan should be adopted as in breeding for pork-making. Sows should have as much liberty as possible, and they should be encouraged to graze the entire summer through. They cannot be kept so cheaply on any other plan, they throw larger and healthier litters, and give far less trouble than when housed. If housing is necessary, then grass or forage crops should be daily carried to them, but under no conditions except when they are with their young should breeding sows require more than a mere handful of dry food in summer, preferably beans or peas. In winter they may be similarly fed with mangels and swedes, upon both of which they thrive well if they have a fair proportion of pollard or middlings, skim milk, and wash. Sows too should always be turned out upon grass with their young after the first three weeks, provided the weather is fine and the grass perfectly dry, otherwise the pigs should be kept in and the sow turned out alone. Young pigs should be fed well from their birth, and encouraged in every possible way to grow; but they must have no food beyond what they can get with their dam until they leave her, when, if for porkers, the food may be gradually changed to milk and barley meal. A few handfuls of peas, beans, or wheat, given daily will benefit them from the age of two weeks. When young pigs of nine weeks old sell at 18s. to 20s. a head, they pay better than pork; and a farmer who maintains stock of high quality will invariably sell well

when dealers have found him out, well-bred pigs giving a larger percentage of carcass than others. To breed with success the boar should have freedom as well as the sow, and if he is young and of a short-nosed variety he may generally be trusted with his liberty on pasture. Exercising and grazing enables both sire and dam to produce more and stronger pigs. Gilts saved for breeding should be allowed to have their first litter at a year from their birth. It is most important in pig-breeding to keep in the right groove as to date, litters falling regularly in March and September, otherwise the delay of a month from time to time throws the spring pigs into summer and the summer pigs into winter, when neither pay their way. Pigstyes should invariably be under cover together with their courts, that the manure may be protected from the rain. Pigs should be fed under cover as well; otherwise, in bad weather the feeders do not give them due attention. The stye should be warm and dry and preferably concreted, with an open gutter down the centre and a wooden bench in one corner. With this, very little straw is needed. The best troughs are of Staffordshire ware or of iron, built in the wall, with a flap door hanging above them, this being bolted back or front as is found necessary to allow the pigs to get at their food or to keep them from it. Pigs should never be littered with barley straw. They do not thrive upon it, the awns annoying them and disclouring their skin, and it causes them to become dirty. Wheat straw is the best and cheapest in the end. When winter feeding, the food should be mixed in tubs



SOW OF THE SMALL BLACK BREED.

[*To face p.* 52.

or tanks, and either warmed or slightly fermented. With plenty of milk, whey, roots, or potatoes, very little meal is wanted, and this the offal of the farm should provide. The best pork is made from barley meal and skim milk, and the next from pea-meal, but, all in all, perhaps maize and pea-meal is the dry food which produces pork at the cheapest rate. Where cows calve both in the spring and autumn the porkers can he bred to better advantage, as milk will be plentiful; otherwise, porkers may be fed in summer to get rid of the milk, and weaners in winter, these being sold as the milk falls off. The following rations will be found to be extremely useful.

Rations for Young Pigs.

	Lbs.
Cooked potatoes - - -	$2\frac{1}{2}$
Butter-milk or skim milk -	$10\frac{1}{2}$
	13

Barley meal and pea-meal, from half a pound upwards can be added to this in fattening.

Winter Rations for Breeding Sows.

	Lbs.		Lbs.
Potatoes -	6	Potatoes -	3
Carrots -	2	Carrots -	3
Barley-meal -	1	Swedes -	6
Skim milk or		Fine pollard -	2
butter-milk -	15	Skim milk or	
		butter-milk -	12
	24		26

Winter Ration for Boars, and Sows with Young.

	Lbs.
Potatoes -	6
Carrots -	4
Cooked maize -	2
Fine pollard -	3
Skim milk or butter milk -	12
	27

Summer Ration for Boars, and Sows with Young.

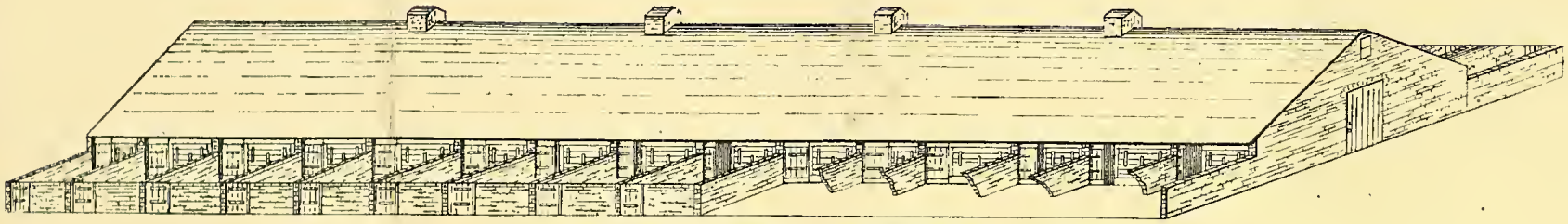
	Lbs.
Fine pollard -	3
Vetches, lucerne, or clover -	12
Skim milk or butter milk -	10
	25

In all cases where whey is provided instead of skim milk the same quantity may be given, but in this case there should be an increase of at least one pound of the pollard, or of two or three pounds of green food.

Summer Ration for Breeding Sows.

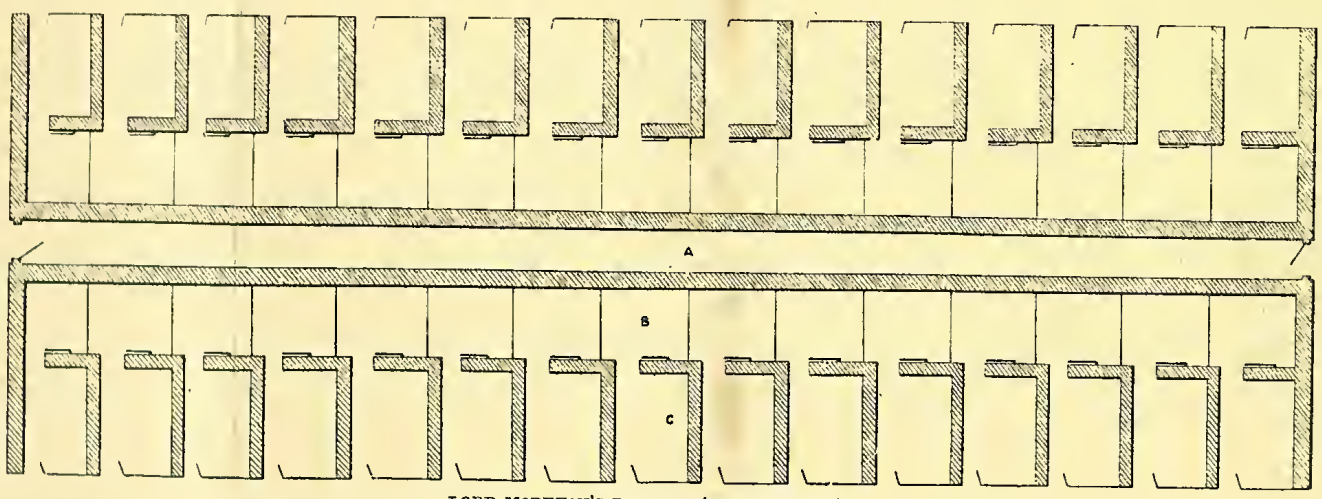
	Lbs.
Potatoes - - - -	3
Fine pollard - - -	2
Skim milk or butter-milk - -	8
Green clover, lucerne, or vetches -	12
	25

It will be evident that these rations will vary in accordance with the size, but they will be found sufficient for medium pigs. In the production of live weight, potatoes have about one quarter the value of barley-meal. Barley-meal and maize have a very similar value in this respect. Mangels are a little more than half the value of potatoes, and white turnips,



LORD MORETON'S PIGGERY AT TORTWORTH COURT.

Height from floor to ridge 14 ft. 6 in. Width (interior) 27 ft.; including Yards 49 ft. 10 in.



LORD MORETON'S PIGGERY (GROUND PLAN).

A. Central Passage, 149½ ft. long, by 5 ft. wide. B. Styes. C. Outer Yards.

[*To face p.* 65.

supposing the two foods are given in their best condition, are a little more than half the value of mangels, but swede turnips are better than whites. Lucerne, clover, carrots, and parsnips have a greater value than mangels, lucerne being the best of these foods. Pigs, not being ruminants, have a much smaller proportion of stomach but a larger proportion of intestines to live weight than either oxen or sheep. They require more concentrated food than ruminants, but are able to make much better use of it than sheep or oxen. From $3\frac{1}{2}$ to 5 parts of dry food will give one part of increase in live weight in the case of pigs fed with such foods. Where whey is very largely used, one of the best combinations of dry foods for mixing with it is three pounds of pollard, two pounds of maize-meal, and half a pound of bean-meal.

Recent experiments have shown that leaner pork and bacon, and a greater weight, can be produced by a more liberal use of such nitrogenous foods as pea-meal and skim milk. In our own experiments with a strain of pigs of the middle white variety, which we have bred for vigour and prolificacy, we have found that carefully arranged rations have immensely added to their value both as breeders and meat producers. In the *Book of the Pig* we have more completely treated this question.

THE DAIRY FARM.

A good average size for a dairy farm is 100 acres, unless it is situated in those counties where the larger kinds of cheese, such as Cheddar, Cheshire, Gloucester, or Leicester, are made. It is well adapted to maintain a butter-making herd, and a great deal more can be done upon this acreage than is generally supposed. One hundred acres of good land will be found infinitely better than 150 acres of inferior land, and even in these times there should be no hesitation in paying from 30s. to 40s. an acre for it, inclusive of tithe, but exclusive of rates. As more cattle can be kept and consequently more milk produced upon arable than upon pasture land, the farm should be preferably divided into as nearly equal quantities of each as possible, the grass providing turn-outs for the summer and hay for the winter, whereas the arable will provide

the bulk of the winter food, together with almost entirely succulent rations for the spring and autumn. This is of the highest importance, for a purely hay ration is the most expensive of any, and grass land does not provide the most advantageous medium for milk production between seasons.

On a well-managed dairy farm the extra cost for labour upon arable land is not in proportion to the extra production of milk, and this is a fact of great importance. Upon a good farm, 100 acres divided between arable and pasture should keep 50 Jersey or Guernsey cattle of different ages, the cows costing from £15 to £16 each, or 35 Devon, Red Poll, or Short-horn cattle, the cows costing £16 to £25 each—these being hardy and usefully selected butter cows. No attempt need be made to specially select pedigree animals, but crosses of the pure breed, which are more than equal to pedigree cows as milkers, might be purchased with advantage. Upon a farm where cheese is made or milk produced for sale, 30 dairy Short-horns costing £22 each, or 40 Ayrshire costing £16 in Scotland, or 35 deep-milking Devonshire cows costing £20 each, might be kept. In the one case it should be the object of the farmer to select butter cows, and in the other cows which are deep milkers. For such a farm, with a herd of cattle formed upon these bases, a capital of from £1,300 to £1,400 would be required. Where so large a first outlay has to be made in the purchase of beasts, this may appear small, but it should be remembered that the dairy farmer turns over his capital very much more rapidly than the corn-grower. With

regard to the cost of labour, we have found that when cows are housed one man is required to attend to the wants of twelve animals. Bearing in mind, however, that the cows would be out most of the summer, we believe that two hired men would be found amply sufficient for such a farm with the active assistance of the farmer and a strong boy. Where the farmer himself takes his place with the men, he may always dispense with one of them upon a purely grass farm.

Upon a half arable farm an extra man would be required beyond the number provided for the grass farm. This man should be available, during the whole of the time the cows are stalled, for working upon the land, at least 40 acres of which he would have to plough. Occasional assistance might be given him in the winter, but during the summer and at all times when the cows could get out, the other men would take their turn in the fields, and the staff would thus be ample to conduct the work in a proper manner. With 50 acres of arable land at least one-sixth more cows could be kept than upon an entirely grass farm. In addition to this a variety of foods would be provided, which would be productive of a marked increase in the supply of the milk from the whole herd. The pigs would be kept cheaper, and some help would be given to the poultry, the extra cost of labour, of horse-flesh, and of implements being far more than covered by the increased returns. If possible, labourers should be employed upon the farm who have wives and growing families.

Upon many of the best farms a man and his wife,

with the help of a son and daughter, are enabled to attend to from 30 to 40 animals at considerably less cost than would otherwise be the case. It pays them better and is more satisfactory to the master, as such people generally take an interest in their work. Success in dairy farming depends so much upon personal interest and upon skill and experience, that at least one competent manager is necessary in addition to the farmer. As cows become barren or are required for sale their feeding has to be specially arranged, and a change in their career has to be adopted at the earliest moment to prevent loss, and it is only the eye and hand of the skilled and interested man who carries this work out properly. In many instances beef-making and dairying is conducted on the same farm, good feeding cows being bought in for the purpose of milking and flesh-making at one time. We know some remarkable instances of success in this line, but feeding for meat is a distinct business. It requires a special gift on the part of the farmer, and should not be attempted by those who have no experience. It is a far better plan in starting a dairy farm to select a breed, to purchase the best animals which can be obtained, and to breed from them, hereafter filling the vacancies in the herd from time to time with home-grown stock. The man who annually buys to fill up the gaps purchases a great deal of trouble with the cows together with a percentage of loss.

It should be part of the foreman's duty, in the absence of the farmer, to weigh the milk at least twice

weekly, both morning and evening, and to enter the weights upon a slate opposite the name of each animal. These weights should be copied by a member of the family, who should be required to keep a ledger account against each cow, showing whether she is a profitable or unprofitable customer, as none but paying cows should be kept in a herd. We regard it as necessary to keep such a record as it is to keep an account against persons to whom the produce of the farm is sold. A similar account should show the actual quantities of food purchased and consumed, both for the cattle and the pigs, the weight of the skim milk consumed by the latter being invariably charged against them. If this is not done, the profit is left to chance, and the farmer never knows whether he is doing the right thing. A portion of his own work should be to keep a pocket herd-book or note-book, showing the dates of calving and of sows due with litters, together with particulars relating to the breeding of every animal in his herd.

With regard to the system of cultivation of the 50 acres of arable land, which as far as possible should be close around the homestead to minimise labour and cartage, we would divide it into six sections, and crop upon a six-course system. The object should be to provide succulent food for every portion of the year, excepting the summer months when the animals are at grass, together with straw and grain for the use of the horses, pigs, and to some extent for the cows. The earliest green crops are rye, trifolium incarnatum and tares, and an effort should be made to produce some of these

crops in succession and as early as possible. The rye will generally come first, to be followed by trifolium, tares and oats mixed and rye grass, the crops being liberally watered with liquid manure. They may be consumed green with immense advantage, the tares being especially adapted for milk, while the trifolium, which is a rich food, is adapted for silage or for cutting in its young state, and for assisting the farmer in obtaining two crops from the same land. In the South of England these three crops may in almost all seasons be succeeded by the giant caragua maize, one of the most valuable forage crops known in connection with the dairy farm, and from which 20 tons per acre may sometimes be easily obtained. Maize may be planted as late as the end of the first week in June, but should preferably be in the land by the first of the month. It yields an abundant crop on good soil, especially if manured with phosphates, and is fit to commence to cut by the end of August, providing a large quantity of luxurious fodder, which can be given to the extent of one cwt. daily, if in conjunction with two or three pounds of cotton-cake. Speaking from personal experience, we are satisfied that in the Southern Counties this crop will, on suitable soils, be found satisfactory in its growth and highly profitable in its nature. Where the rye, the trifolium, and the tares can be successfully removed, and maize or white turnips obtained as a second crop, at least three or four more head of stock can be kept upon the same 100 acres. Instead of an ordinary one year's clover, a clover ley upon the dairy farm might last for three or four years, and consist of

the following seed mixture, which may be varied in accordance with the nature of the soil :—

			s.	d.
2 lbs.	Broad clover - -	at 10d. -	1	8
2 „	Cowgrass - - -	1s. -	2	0
2 „	Alsike - - - -	1s. -	2	0
4 „	Sainfoin - - -	8d. -	2	8
4 „	Italian rye grass -	3d. -	1	0
8 „	Perennial - - -	2½d. -	1	8
4 „	Timothy grass - -	5d. -	1	8
3 „	Cocksfoot - - -	1s. -	3	0
1 „	Foxtail - - - -	1s. 2d. -	1	2
1 „	Tall oat grass - -	9d. -	0	9
2 „	Trefoil - - - -	4½d. -	0	9
3 „	Lucerne - - -	1s. -	3	0
36 lbs.			21	4

The lucerne should only be added upon deep soils which contain lime. Upon heavy chalk soils of less depth, the same weight of sainfoin seed might be used in preference. We have found both of extreme value when grown in this way. The best roots for heavy or medium land which can be well tilled, a fine tilth being essential, are long red mangels and hybrid swedes—the swede being used for pigs, for young stock, and to some extent for cows, the mangels being reserved for the milking cattle until the spring, and consumed just before the green food first comes in. Cabbage is necessary as furnishing a succulent food in the early part of winter before mangels are used, and when grown in succession it comes in at least

GIANT CARAGUA MAIZE.

| *To face p.* 72.

three times during the year with great advantage. The most profitable kinds are drumheads and thousand-headed kale, both of which should be drilled in a rich seed-bed.

Ever dairy farmer should cultivate potatoes for his cattle. They are an agreeable change, they make rich milk, and contain twice the quantity of feeding material which is found in mangels or swedes. They are, moreover, of still greater value as a pig food, and should be given in early winter before they have commenced to lose much weight. Lucerne might be grown near the homestead. It will furnish three cuttings yearly for five or six years, and should not be kept down longer, as it is then overcome by weeds. It will not thrive on wet soil, but will furnish an abundant cut in the hottest summer when almost every other plant is famished and dry. Under suitable conditions, and they are not uncommon, lucerne is the mainstay of a herd, and should, therefore, never be omitted. Oats will furnish a rich and perfect addition to the ration of the cows, but must be ground. Oat straw is the best of all straws as a cattle food, both because it is richer, and because it is much more digestible, and this, together with the barley straw, should furnish chaff for the winter's ration. Lucerne, like the clover ley, may be grown with the grain crops, and the rotation might be somewhat like the following:—1, Oats; 2, clover ley; 3, green rye, trifolium or tares, followed by maize or turnips; 4, cabbage and potatoes; 5, barley; and 6, roots.

Acreage and Crops for Heavy and Medium Land.

	Acres.		Acres.
Rye - - -	2½	Cabbage - -	3
Trifolium incarnatum and rye grass - -	2½	Potatoes - -	5
		Lucerne - -	2
Tares - -	3	Oats - - -	8
Clover ley - -	8	Barley - -	8
Roots - - -	8		50

Upon thin land containing lime, such as chalk, sandy loam, or gravel, the lucerne may be replaced by sainfoin. Kohl-rabi may form a portion of the root crop, partly replacing swedes. The mangels should be of the tankard variety, in place of the long reds. Rye may be grown to a larger extent where the land is unusually poor, in place of either of the other crops. Upon very heavy clay, artichokes may be grown with considerable advantage and profit. These tubers are easily cultivated, costing little to produce. They are of great value for milking-cows, and may form a permanent plant upon a piece of land unfit for any other purpose, growing only from the small tubers which are retained in the soil.

In the cultivation of all the above crops it should be the aim of the farmer to produce quantity by liberal manuring and careful cultivation, as quantity of crops means quantity of milk. Milk depends upon the nitrogenous food which the crops contain, and as

THOUSAND-HEADED KALE.

KOHL RABI

[*To face p.* 74.

one pound of this nitrogenous matter yields about 5½ lb. of milk, it follows that the more of this constituent we can obtain from the land, the more milk will be yielded; but the soil cannot yield nitrogenous matter in the plant unless it is itself rich in this substance. To enrich it, therefore, manuring and good cultivation are both necessary, the one to place the nitrogenous matter in the soil, and the other to so pulverize the soil itself as to make it available to the plants.

The dairy farmer must remember that in sending away his butter, his cheese, his milk, and his calves, he is taking a large qnantity of rich material from his soil, which is not replaced in the manure unless he feeds liberally upon rich foods. To return to the soil only the manure of the foods he grows would mean an annual loss to the soil, because nothing would be done to replace the matter which is taken away in the milk. If, however, he feeds liberally upon such foods as cotton-cake, which is of the highest manurial value, he may not only maintain the richness and fertility of his soil, but practically increase it. Cotton-cake, therefore, which contains so much nitrogenous matter—the essence of milk—should always be used upon the dairy farm. Sir John Lawes has shown that when a cow is in milk, and provided with a proper ration, each 1¼ lbs. of cotton-cake produces an extra gallon of milk up to a certain point. It is questionable whether any other class of food can be used to the same advantage. Peas and beans, though less valuable, might be grown to advantage for consumption by the cows, but we believe that it will be generally found

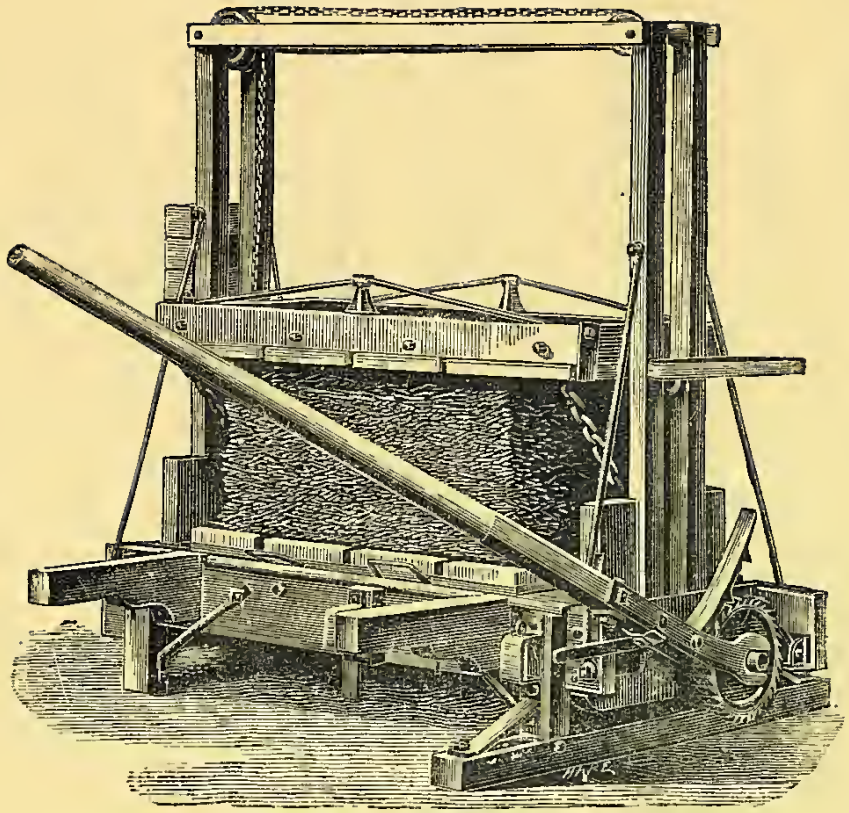
cheaper to buy than to grow them. The clover ley should invariably be manured with phosphate of lime; and the maize crop, following closely after the other crops, should be heavily manured with both dung and phosphates.

HAY-MAKING.

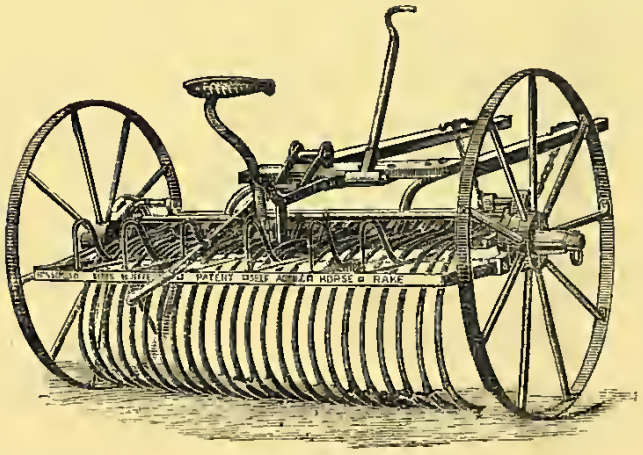
The chief object of hay-making is to provide winter food for stock, and it should not be the aim of the dairy farmer to attempt to provide bulk in preference to quality, for it has been shown over and over again that well-made hay from good grass is infinitely more valuable than badly-made hay in much larger quantities from inferior grasses; indeed, whatever the grass, its feeding property should be almost entirely preserved in the process of drying. Grass contains certain feeding constituents, which are well arranged by nature and necessary to stock. If the grass is cut too early there is a loss of bulk or a loss of some of its constituents, because of its then immature state; whereas if it is cut late, a large portion of the food in the stem of the grass is converted into indigestible fibre—the seed, which is partly lost during the process

of hay-making, carrying off another portion of the feeding constituents of the plant. The object, therefore, should be to cut at the right moment, when the plant is sufficiently strong to bear the scythe, and before the ear containing the seed has ripened; just, in fact, before it commences to turn in colour. Unfortunately, meadows are generally composed of grasses which ripen at different periods, and therefore it is impossible to cut when the grass as a whole is at its proper stage. For this condition the farmer often has himself to blame.

A meadow, properly speaking, should be composed of grasses which flower at almost the same period. On the contrary, the pasture should be composed of grasses which flower at different periods, so that the grazing stock are provided throughout the entire season with fresh herbage. The system of combining the pasture and meadow in one field partially destroys the successful conditions of each. It must be remembered, too, that grass loses a portion of its feeding value by conversion into hay. By fermentation in the rick, part of the starch-like substances in the hay is converted into sugar, and, where there is excessive fermentation, into alcohol, and sometimes into acetic acid. It is these changes which so much influence the aroma of hay, whether it be sweet and fragrant, or sour and disagreeable, and thus the aroma like the colour, which should be green, is an indication of quality. If grass is made so that it is preserved in colour, and if it has a perfect aroma, it is well saved, and there is but little loss. If it is cut when immature,



HAY PRESS.
(Barford & Perkins, Peterborough.)



HAY HORSE-RAKE.

[*To face p.* 79 *or* 80.

or stacked when too damp, the fermentation, denoted by the depth of its colour and its stronger smell, causes considerable loss, so that 40 lbs. may not be of the same feeding value as 20 lbs. would have been had it been properly saved. When hay has been subjected to wet the stems and leaves are constantly fractured, and these fractures permit of the escape of much of the nutritive properties which it contains, they being washed out by the rain, more especially when the grass is too young. Young grass, however, is richer as a food than old grass; and if just sufficiently mature, it is more profitable to cut it for feeding, as there is less labour. It helps the farmer forward with his work, and it provides him with earlier and more abundant aftermath. It is evident, too, that in mowing, the grass should be cut low, as the bottom herbage is generally the richest. Whether a mowing machine should be used depends upon circumstances. Such a machine is useful where there is a large staff, in order to cut a quantity of grass in a short time, but it should never be used to cut so large a quantity that on pressure by weather it might be impossible to save it rapidly. It is a far better plan to cut a little at a time, and to save that little. As the rain comes on, the grass should be left in the swathe, as it is least damaged in this condition; or, if it has been partially made into hay, it should be left in cocks.

Although hay should never be carried really moist, it must necessarily have some moisture in its composition in order to assist in the necessary fermentation

in the rick, for without fermentation there would be little aroma. Grass sometimes dries into hay under a hot sun, and is fit to carry in a day; but the best hay is made by drying in the wind, hence the adoption of wind-rows, into which hay is drawn after being laid open to dry. Hay made under a powerful sun may be so scorched as to largely decrease its value. Where hay contains much clover or many large-leaved plants, great care must be observed in moving it, or a large percentage will be lost, owing to the brittleness of their nature when dry. In stacking, the rick should be smaller at the bottom than at the top, and the shape preferably oblong, presenting as little surface as possible. The roof, too, should be sloping, but only at the sides, and should not be too high—a stack 12 feet through having a slope on each side of about 10 feet from eaves to ridge. Much nutriment is often lost in a good stack which has been placed in a bad position, by reason of its attracting the moisture around it. A rick should, therefore, be built high and dry, and well protected with a good wheat straw thatch. During building it should be protected with a rick-cloth. Mr. Sutton has recommended that, instead of using sacks of straw in the centre of the rick to prevent over-heating, layers of straw should be placed occasionally in the rick to absorb the surplus moisture from the hay; but this plan would only be applicable when hay is intended for home consumption. When hay has been badly got, it may be improved by a good salting at the rate of one cwt. to every five tons.

The best hay is composed of fine or rich grasses, with a good proportion of trefoil, alsike, white and red clovers. Such hay is made on land which has been drained and which has also been subjected to careful treatment, good manuring aud harrowing, that the manure may be distributed, and the uneven surface of the ground, together with mole-hills, removed. It must also be rolled, to further level and to solidify—grass growing best on a firm soil. It must have been carefully stone-picked, and be surrounded with secure fences to prevent the ingress of cattle or sheep. On light land a plain roller would be found the best, but on heavy land a ring roller or presser would be advisable. Some good, too, will be done by the removal of docks, nettles, and other coarse weeds, which, besides their uselessness, are liable to assist in the over-fermentation and firing of the rick. Where hay has been half spoiled by wet, if it is in any quantity, it may be preserved from ruin by placing in a silo. In Switzerland we have seen the peasantry and small farmers make their hay four times within the year—the October hay being principally dried by fermentation in heaps—but in the usual way they cut four to five times for their cattle, which in rich districts are invariably housed. Mr. Sutton says that Dr. Thompson has shown that 387½ pounds of grass are required to make 100 pounds of hay. The loss is chiefly water, but not entirely so. This is borne out by the fact that an animal which thrives on 100 pounds of grass will not do so well upon 26 pounds of hay supplemented with 74 pounds of water. The loss of

nutritious ingredients is of course attributable to the process of fermentation carried on in the stack; but in return for this loss the fermentation may have to some extent broken down the woody fibre of the grass stems, and rendered them more digestible.

FARM-YARD MANURE.

As the object of manuring land is to maintain or increase its fertility, by the repair of waste, by putting back what is taken out of the soil by the crops, it is evident that manure is an article of great value, and should therefore be carefully preserved. Upon land, such as prairies in foreign countries, where no crops are taken, or where no animals feed, the plants which are produced mature and die and are practically returned to the soil, thus sustaining its fertility; but more than this, as much of the food which the soil contains, and which is extracted by the plants, is brought down with the rains, these prairie lands are more than sustained—their fertility is increased. In this country, however, we take crops or we place cattle upon our fields to consume them. The plant-food, therefore, which is supplied by the natural rains is not sufficiently abundant to replace what the soil loses, and therefore it is essential to return to it the manure which is produced upon the farm. Nor is this

manure sufficient to repair the waste which goes on, for on every farm a large quantity of some kind of food, either grain, or meat, or milk, is exported and absolutely lost to the soil. It is this loss which the farmer must endeavour to make good; and he can only do this, first, by returning to the soil all the manure, solid and liquid, which his cattle make, taking care that its value is maintained by protection from the rain; second, by the use of artificial manures, or what is almost equivalent, by the consumption of purchased feeding stuffs; and, third, by cultivation, which enables the soil to avail itself of the manure which is given it and to furnish it to the plant. It is difficult to convey in a few simple words a practical lesson on manuring, as it is so closely connected with science; but as agriculturists study manuring more and more, they will learn to replace in the soil the actual plant-foods which have been extracted by their crops, and which have been conveyed off their farms in the form of grain, hay, milk, or meat. The dairy farmer has an especial advantage in being able to deal with a large bulk of manure, which he can make of high quality if he purchases freely of cake and other feeding material. It is to his advantage to do this, especially as the manure obtained from such sources is tolerably cheap. The manurial constituents taken away from the farm in milk consist not only of mineral matter, principally phosphates, but something much more valuable than these—the nitrogen, which is the most expensive of all manures—hence the extended use of cotton-cake for dairy cows, for these cakes have the advantage of being

both milk-producers and manure-makers. It has been said that a farm with ample stock should manure itself once in four years at the rate of 16 tons an acre. This, we believe, it may do, unless the manure be kept in a covered yard. Supposing the head of stock on 100 acres to number 50, or the equivalent to 50 head of cattle, including horses, pigs and calves, they would void about 50 tons of dung per month, and with a moderate supply of litter daily another 50 tons would be added, making 400 tons during the winter season. This would be exactly enough to manure the farm at the rate suggested. In many cases, however, less litter is now being given in covered yards; but it will be remembered that in almost all cases the cattle are housed, wholly or in part, for at least seven months, so that this quantity of manure might actually be obtained even in such a case. In open yards a much larger quantity of litter is necessary, and added to this will be a large bulk of rain-water which will increase the manure to the extent of at least 25 per cent., at the same time deteriorating it in value. Manure should never be allowed to heat above from 85 to 90 degrees, more rapid fermentation causing a loss of the most valuable constituents. In using manure it is better to place that containing a large quantity of straw on heavy land, which it lightens, enabling the air to enter. Such manure may also be placed upon the land and ploughed in in the autumn for the use of the following season's crops; but as dung is never wholly available to plants at once, even when rotten, and as new dung is still less available, it should not be

used when it is required to nourish immediate plant growth. For this purpose rotten dung is necessary. It affords immediate assistance to some extent, and is also more suitable for light soils. Rotten manure, weight for weight, is more valuble than fresh, because it is more concentrated and soluble; and although it may have undergone considerable fermentation, which is necessary up to a certain point, it will not have lost much of its value. In every ton there is, according to the quality of the food used in its manufacture, from 9 to 15 lbs. of potash, from 9 to 15 lbs. of nitrogen, and from 4 to 9 lbs. of phosphoric acid, these forming the three most valuable ingredients of all manures, as they are the three principal plant-foods. Sir John Lawes values potash at 2½d. per pound, phosphoric acid at 3d. per pound, and the nitrogen, estimated as ammonia, at 6d. per pound. Seventeen parts by weight of ammonia are equivalent to fourteen parts by weight of nitrogen. Thus it will be seen that good dung not only contains the leading and essential foods for plant life, but it contains them in considerable quantities, and is therefore of great value. Farmers should bear this in mind when they have the opportunity of purchasing dung which has been produced from well-fed animals and carefully preserved, but they must remember that it will not yield them the same immediate return as artificial manure, as its effect is spread over a longer term of years.

The liquid manure from cow-houses and piggeries should be saved as carefully as the solid; and to this end it should be encouraged to drain, by a simple

system of gutters and pipes, into a properly constructed tank where it cannot be weakened by the addition of rain-water. Solid manure should be carted by barrow or tram on to a properly constructed heap with squarely built sides, or into a pit lying at a lower level than the floor of the cow-house; in either case the manure heap being covered by a permanent roof, preventing the addition of rain-water. It is the careful covering that it receives that makes the manure prepared in boxes more valuable. Another plan, common in France, is to pave a yard and to surround it with walls about four feet in height. This yard is covered with a simple roof, while in the centre a large tank is sunk and a pump erected over it to the height of 6 or 8 feet. Within the walls and around this pump the manure is piled, and from time to time the liquid is pumped from below and spread over the solid manure above. Into this tank the whole of the liquid manure from the different stock buildings is carried, and so there is no loss from any source. In some cases the manure is continually covered when fresh with layers of earth, with the object of fixing the ammonia which it contains, but this entails considerable labour both in bringing the soil to the heap and in carting it away to the fields; moreover, if the plan suggested is followed there will be no necessity for it. Upon the basis of the above figures in a manure of only moderate quality the ammonia will be worth 6s. 3d., the potash 2s. 1d., and the phosphoric acid 1s. 3d., or a total of 9s. 7d. a ton. If this is the case, it would seem to be utterly reckless to expose such a valuable article to

the mercy of the elements; but in the majority of cases small farmers are not able to sustain the cost of the erection of manure sheds and covered yards for themselves, and in others landlords are not willing to expend the money.

LAYING DOWN LAND TO GRASS.

Unless land which it is intended to lay down to grass is porous, resting on a chalky subsoil, or is sloping, it should be previously drained; for the best varieties of pasture and meadow grass will not flourish upon wet soils, especially those which are water-logged. Although plants are nourished by rain, which should pass through the soil into the subsoil beneath, they derive no nourishment from, and the rain is unable to penetrate, heavy wet soils from which it practically runs off. Drained land is warmer in spring and autumn than similar but undrained land, and consequently grows earlier as well as later herbage and always in larger quantities. It is not so liable to damage by poaching from the feet of stock, and is in every sense much better, both as a seed-bed and as meadow or pasture, than land which is undrained. Upon most soils the drainings should be shallow, at

the most three feet, the distance of the drains apart varying with the nature of the soil. An ample fall should invariably be given to the drains, and there should be no sharp angles from the small into the larger ones. On low lands, where it is impossible to find a sufficient fall for drainage, it is preferable to cut channels across the fields in the best positions, that the water may be encouraged to keep off the grass. In commencing to prepare land for laying down, if it is impossible to summer fallow in the previous year, which few farmers can afford, a root crop should be taken. For this the soil should be well manured, twice ploughed, and drag-harrowed. At least four or five harrowings should be given in the spring, with intervals between each, so that as far as possible weed seeds should be encouraged to germinate that they may be destroyed. Where no sheep are kept there is no crop for spring laying down superior to mangels. This crop, which acts as a cleaning crop, should be got off and stored early for the use of the cattle. The land should then be ploughed and also, if possible, cross ploughed, and left for the influence of winter frosts, care being taken not to plough too shallow. In the spring, dragging and harrowing should again be proceeded with, and more weeds grown and killed. Every effort should be made to produce a fine level surface with the aid of fine harrows and the roller, for upon this perfect tilth chiefly depends the success of the crop. Wherever there are holes, clods, or depressions in the surface, there the fine seeds will fall and be lost, as they seldom

germinate, even in a fine tilth, below half an inch Where sheep are kept, land may be further improved by feeding off the turnips, the animals being at the same time fed upon cake or corn. In either case the grass seed will benefit by the manure which has remained in the soil through the winter, and which is in a fit condition to afford immediate nourishment. When the land is ready, as it should be a week before seeding, the weed seeds will again germinate, but they may be partially destroyed by a final harrowing and rolling before the seeds are distributed. This rolling is very necessary, as grass requires a firm compact bed which mere harrowing will not give it.

In all cases, in laying down permanent pasture, the seeding should be ample, and, in ordinary circumstances, this will be well repaid. The seeds should include perennial rye grass, which will make a return during the first season, and this no other permanent grass will do. Much as it has been abused, it is one of the most valuable grasses that we have, and is found in almost all the richest pastures in the country. Having selected the variety of seeds—a most important point—and purchased them separately of a reliable firm of seedsmen, the seeds should be divided into two lots, the lighter, such as foxtail, rye grass, and the fescues, and the heavier, such as timothy and the clovers. The latter should be distributed by means of a seed-barrow, the former being broadcasted by an experienced man on a fine, still day, preferably when the soil is moist, but when it can be rolled without fear of any clog upon the roller.

Grass seeds may be sown among grain plants, especially stiff-straw barley, or oats, without any fear of ill results. Upon a firm bed of stiff soil it is preferable to use a ring-roller before seeding, and to harrow across it, subsequently rolling with a smooth roller in the same direction; but the harrow used after seeding should be made of bushes, preferably of blackthorn. In every case where there are stones in a field, they should be removed before any rolling takes place. After seeding, a careful examination of the field should be made in order that weak spots, where the soil is shallow or where clods are plentiful, may be levelled and properly seeded. Having purchased the seeds early, they may be tested while the land is being prepared. The best plan is to provide a red flower-saucer, which is kept moist by constantly standing in water. In this a hundred seeds are counted out and their germination encouraged by moisture and a moderately high and even temperature. In a few days the seeds will have sprouted, and the percentage of fertile ones ascertained. This plan will prevent any subsequent fear as to the fertility of the seeds.

Autumn laying down has been both praised and abused. It has many advantages, although, in consequence of risk to the clover plant, it is often undesirable to sow clover until the winter is over. Potatoes form the best preparing crop for autumn sowing, as they are got off sufficiently early to permit the land being thoroughly cultivated. In this case the same method of procedure should be adopted both before and after the potatoes, as in the case of

spring sowing; and as the land will be warmer than in spring, there will be no difficulty in starting the seeds into early growth. From the same cause weeds are easily killed. The sowing of rye grass, trifolium, timothy and cocksfoot, meadow fescue, and the leading strong grasses may always be attempted with certainty if they are sown by the end of August, or in the south by the middle of September, as they are hardy and will stand a severe winter. With these we have succeeded in obtaining, after a September sowing, 2½ tons of hay per acre in the following spring. Autumn harrowing of old leys and comparatively worthless fields which have laid themselves down, is a useful assistance when it is intended to renovate in the spring; and, indeed, in some cases renovation is practicable in the autumn itself, the strongest varieties of seeds only being used. In the first year of a new pasture the roller should be well used and the weeds mown, and if the plant is a good one and the soil firm, cattle may be put upon the aftermath and fed upon cake, with great advantage to the growth of the succeeding year. At first, as subsequently, much depends upon ample manuring. The grasses which will be found the most valuable to include in the mixture, whether for pasture or meadow upon the various soils, are the following:—

Meadow Fescue, which is one of the best, if not the best grass grown, thrives upon strong moist soils so long as they are not poor and thin. It provides plenty of late herbage, and is rich and ample. There is no grass superior for dairy cattle, and indeed it is more largely grown upon the pasture in the best

dairying districts than any other variety. It is also useful for irrigation.

Tall Fescue prefers strong moist soils, and is suitable for laying down pasture on low lands, even though they be somewhat wet. It is not so suitable for meadows.

Hard Fescue is also suitable to most soils, but they must not be wet or water-logged. It provides rich close bottom herbage, and grows well at the end of the season.

Fiorin is suitable to light land and flourishes upon moist and even wet soils. It is a creeping plant and on this account is largely objected to, but it provides a large quantity of fairly good herbage upon soils where the majority of other plants will not grow. It is not good for hay.

Sweet-scented Vernal is a grass of fair quality providing a good after-growth. It will thrive upon poor and sandy as well as rich soils, and is suitable for irrigated land. Its aroma is greatly valued in hay-making districts, and it is communicated to the entire rick.

Crested dogstail is another useful grass which provides plenty of bottom herbage. It is more suitable to loam and chalk, but will grow on clay subsoils if they are tolerably dry. It is useful in a pasture but not so valuable in a meadow.

Foxtail is one of the most valuable grasses which are grown, although its seed is one of the least fertile, and it takes from three to four years before it arrives at maturity. It is an early grass, blooming in early May,

TIMOTHY GRASS (PHLEUM PRATENSE).

[*To face p.* 95.

and is thus most valuable in the pasture and on lands suited for hay-making. It is also a quick grower after the scythe, providing abundant aftermath. It is suitable for irrigation, and thrives best upon drained heavy soils. The seed is unusually light and rather dear.

Yellow oat grass is useful on chalky soils but is not a plant of the highest quality.

Tall oat grass is better for stock, but it is not perennial. It will grow on almost any soil which is not a wet one. It has a deep root and will withstand drought. It is also well suited to alternate husbandry or leys of three to four years.

Smooth-stalked meadow grass grows well upon lighter soils, excepting sand, and on most heavy soils. It is essentially a pasture grass, being one of the earliest to grow, which it will do even during late frosts. It withstands drought and is perennial.

Rough-stalked meadow grass is suitable for irrigation.

Water meadow grass is also suited for irrigation.

Cocksfoot grass is one of the heaviest croppers known before hay-making comes, but it is not so good for pastures as for meadows. It enjoys a moist stiff soil and will not flourish during drought. It is specially valuable for leys and alternate husbandry, coming to maturity in its second year. It will grow under trees in profusion, and when young is exceedingly rich and valuable for dairy cattle.

Timothy, or Catstail, will grow on almost any soil (excepting sand, gravel, or soils with a dry surface).

It is exceedingly fertile, stands drought well, is hardy, and a heavy cropper. The seed is unusually cheap and may be used in conjunction with perennial red clover or cow grass upon a three or four years ley. For this purpose timothy is one of the most valuable of known grasses, being rich in quality, abundant in quantity, and a certain cropper.

Italian rye grass is chiefly valuable for growing alone or for the purpose of irrigated and sewage cropping. It will grow upon any class of soil, more especially that which is rich and humid. It may be sown in autumn or spring alone or with trifolium in the one case, or with clovers and trefoil in the other. Mixed with perennial rye grass, cow grass, red clover, timothy grass and cocksfoot, it forms one of the best leys which can be laid down.

Perennial rye grass is superior to the Italian, inasmuch as it is suitable for use on pasture and meadow. It is especially at home on heavy clays, but will thrive upon all soils excepting sand and gravel, or land which is water-logged. It will stand drought well and provides abundant herbage during the first two years, when the finer grasses fail to produce anything. It is well adapted for irrigation, produces in all cases great weight and an exceedingly rich food.

White clover will grow upon almost any land which contains lime. It will stand drought or wet, but is more suitable to the pasture than to the meadow.

Broad red clover will also grow upon almost any soil. It is, however, not suitable to pasture, and not

adapted to autumn sowing. It provides an abundant cut for one year, of rich succulent food well suited to dairy cows and pigs.

Perennial red clover or *cow grass* is hardier than the broad variety; it stands drought better and is a later cropper. This variety is not so generally appreciated as it ought to be on account of its hardiness, its great suitability for pasture or meadow, and its richness as a food.

Alsike is the only one of the clover varieties which is suitable to irrigated meadows. It is adapted to most moist soils, especially those which are heavy. It will not stand drought, although it is very hardy, and adapted for meadow, pasture, or clover ley.

In some parts of England grasses which in other parts are considered weeds, such as Agrostis and Yorkshire fog, are grown and appreciated. We have found the latter to be largely cultivated in France. It is difficult to condemn practices like these, which are found to answer in certain localities, especially as some of the grasses which we praise the highest are similarly condemned in America and Australia. The following is a list of grasses best suited for the purposes of irrigation: alsike, clover, foxtail, sweet-scented vernal grass, meadow fescue, perennial rye grass, Italian rye grass, rough-stalked meadow grass, water meadow grass.

Sinclair says that all superior pasture grass will thrive under irrigation, providing the water meadow be properly constructed, *i.e.* if the water be perfectly under command, so as to be admitted on the land and carried off from it at pleasure.

Grass Seeds for mixtures on different soils.

	Light Soil. lbs.	Medium Soil. lbs.	Heavy Soil. lbs.	Wet Soil. lbs.
Timothy - - -	3	3	4	3
Meadow Fescue - -	4	7	6	3
Tall Fescue - -	2	2	4	3
Cocksfoot - -	8	6	7	5
Dogstail - -	2	1	1	—
Sweet-Scented Vernal -	1	1	1	—
Foxtail - -	3	5	5	3
Perennial Rye Grass -	6	5	5	6
White Clover - -	2	1	2	2
Alsike Clover - -	3	2	2	1
Perennial Red Clover -	2	2	3	2
Rough-stalked Meadow	—	1	1	1
Lbs.	36	36	41	29

IRRIGATION.

During the past half-century several systems of irrigation have been introduced, but there are only two or three, at the outside, which are worthy of attention. It should be observed in the first place that all lands are not capable of being subjected to irrigation, and that the majority must necessarily be drained. One object in irrigating is to give the plants as much water as necessary from time to time, never allowing it to remain too long upon the land, or more harm than good would be done. By alternately flowing water over the land and running it off, the best results are obtained, and in warm weather grass crops in particular grow abundantly. The two chief systems worthy of adoption are those applicable to inclined land and to level land. In the former case what is known as catch work is the best system to adopt. The land is divided into beds of from 30 to 40 feet in width. Between these beds a number of shallow channels are dug. These channels are fed by a larger channel which may run at

right angles or at an acute angle with them. Where beds are laid across the slope, for a declivity is necessary, it follows that when the water is run into the main channel it feeds the smaller ones, and when flushed it flows from them over each bed, where it is caught in the next channel, and again flows over the succeeding bed, for to these small channels there are no outlets. On arriving at the bottom of the field it is caught by a larger channel which carries it away. Where a natural system is adopted it is therefore necessary that the water which is to feed the land should be above it, and that the outlet by which it is carried off should be below it. The small channels are generally made of variable width, being widest near the main feeder and narrowest at the other end. On the other hand, the main channels are generally smallest at their commencement, increasing in width towards the end. These points are of importance and will be found so in practice. Great care is necessary, in so arranging both the width and depth of the channels that they will permit the water which they convey to flow freely over the land without omitting any part. A very slight incline is sufficient in order to achieve success. It is quite common, where this plan is adopted, to let the water flow for at least fourteen days, and subsequently to give the land a few days rest, care being taken that between the floodings it is not baked by the sun. If it is possible to irrigate in this way from a pond or stream, so much the better. It is better still if sewage can be turned into the main channel and mixed with the water.

Where sewage is not available, it is a common practice to manure the beds, the water dissolving the soluble and valuable ingredients, and carrying them into the soil. The greatest possible benefit may be derived from watering inclined land from a stream which is dry in summer. If it is placed above the land, the water it yields during the remainder of the year may be caught in a pond or reservoir, and turned on to the land by means of channels similar to the above during suitable weather. In the neighbourhood of Milan, in Italy, there are nearly 800,000 acres of grass, four-fifths of which are regularly irrigated by a similar system to the above, although it is carried on on a larger scale. The meadows are practically under water almost all the winter, indeed a great portion of the year. The water is drawn off only a few days before the grass is cut, that the soil may be rendered sufficiently firm for work. When the field is cleared the water is again turned on, and in winter it generally prevents the soil being frozen. By this means the earliest grass is obtained and a cut is made by the end of February. This water meadow system enables the farmers of the districts to obtain about twelve times as much grass as is cut on the ordinary meadow, but manure is freely used. In England, water meadows may be flooded freely when frost is expected, and the grass will be protected against all but the most severe frosts. When the thermometer is above freezing, the water may be run off to give the land the benefit of the alternating system. Like the Italian plan, this assists the farmers in our own country to obtain the most abundant and

earliest spring crop. The plan, too, works more safely during the winter than in the heat of summer. Where water is not sufficient to be flowed over the beds, it may be advantageously carried through them by means of narrow channels cut at shorter distances apart.

The great value of irrigation, as of water meadows, is not so much in the increased yield of grass, although that of itself is sufficient, but in the fact that a spring crop is provided several weeks earlier than usual, this being the most valuable keep of all. It should not be forgotten that the length of time which the water is allowed to flow over or lie upon the meadow depends upon the temperature of the season. Grass land may be irrigated much longer in winter than in summer, varying from three weeks in the winter to four or five days in the summer, taking care that the land is left moist and in nice condition, and that the water is turned on again before it commences to harden. During winter, or say from November to February, alternate flooding and drying may be adopted, excepting that during frost the water should be allowed to remain.

For flat land it is evident the catch-work system can scarcely be adopted; therefore, without going to great expense in the provision of pipes, the most practical plan to adopt is to arrange the land in beds of thirty feet. They should have crowns in the centre sloping at each side to the small furrows or channels which are provided between them. On the ridge or crown of each bed, narrow gutters or channels are made. Down these channels the water is forced, either by mechanical power or by the natural and forcible flow or flush from a pond

or stream. As the water runs down the channels in abundance, it flows over the beds, reaches the furrows between each, and is so carried off. In this system a feeding channel as well as an outlet channel must be provided. The work is not expensive, but it requires judgment to carry it out properly, and, with occasional care and attention, it will last for years. It will be seen that the channels on the crowns of the beds are on a level with the feeder, and that those between the beds are on a level with the outlet. It is only fair to say that grass produced upon sewage or ordinary irrigated land, although more abundant, is not so valuable as that produced in the ordinary way. More than this, grass produced by means of sewage is not an advisable food to give to dairy cattle where butter or cheese is made. It has been found by experience that neither crop is so rich, and that neither will keep so long. As a stock food, however, grass produced by irrigation is of the greatest possible value, its abundance enabling the farmer to keep more head than he could otherwise do. Some years ago a system of pipes was introduced at Stoke Park, near Slough. These pipes were laid over the land at intervals of 20 feet, and were connected with main pipes which ran down the centre of the field. Water was forced through the entire system by steam power, and as the small pipes (which were $1\frac{1}{2}$ inches in diameter) were perforated at various angles, they irrigated the land to a depth of 10 feet on either side. Arrangements were made so that any portion of the land could be watered at will by turning on taps. By this plan 2,000 feet of piping was

required per acre; and although, when tested, it yielded a return of £40 per acre, as against £14 7s. 6d. yielded upon similar land not irrigated, the system has not been adopted, the expense of working being so heavy.

DAIRY FARM ACCOUNTS.

THIS little work is concluded with a few examples or specimens of accounts and records which, although in a more amplified form, the Author has found useful in his own practice. Farmers are not, as a rule, good book-keepers, but we venture to think that they will find the following both practical and simple.

Receipts.

Date.	Butter.	Milk.	Cream.	Cheese.	Cattle.	Calves.	Pigs.	Produce—Grain, hay, &c.	Total.

This account will show monthly and yearly totals of the sums received under each heading. It can be extended or modified at will, and each page may provide for a week or a month.

Expenditure.

Date.	Wages.	Rent.	Rates, Tithe, and Taxes.	Foods purchased.	Manures purchased.	Stock purchased.	Trade accounts.	Seed.	Total.

The totals under each heading added together will show the year's money expenditure, while, added to the old valuation, they furnish a sum which, deducted from the receipts gross total, will give the nett profits (if any).

The individual items included in both accounts should be entered with the names in an ordinary cash-book at least once a week—the payments on the one side, and the receipts on the other.

Where goods are sold on credit, they should be entered in a ledger in the ordinary way.

Milking Account for January 1887.

1887. Week ending	Daisy.	Lady.	Polly.	May.	Total.	Remarks and Rations given.
	lbs.	lbs.	lbs.	lbs.	lbs.	
Jan. 1	126	132	Calved Dec. 30th.	128	386	30 lb. turnips, 12 lb. straw, 12 lb. hay, 6 lb. cotton cake.
15	133	64	220	142	559	Do.
22	267	Dry	232	131	630	Do.
29	254	—	246	171	671	Cake increased to 7 lbs.

In this account, which is based upon daily, bi-weekly, or weekly weighings of milk, morning and evening, the actual yield of the milk of each cow is shown per week, month, and year, when the columns are totalled, together with a record of calving, drying, and the rations given. In a large herd, the entries can be carried over a page or two, showing a similar return, while in each case the weekly yield of the herd is shown by cross casting.

The weights of the milk of each cow should be recorded upon a slate hung in the cow-house.

Butter-Making Account.

1887.

Bi-weekly churnings.	Weight of milk represented.	Cream.	Butter made.	Lbs. of Milk to 1 lb. of Butter.	Temperature of Dairy.	Skim and Butter Milk used for Stock.	New milk used for Calves.	Remarks.
	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	
Jan. 3	350	40	13	26·9	57	247	26	
7								
10								
14								

In this account, which shows churning twice weekly, but can be adapted to any other period, the milk skimmed is calculated in accordance with the weighings, which should, in this instance, be perfectly taken twice weekly. The total weight, minus what is used, sold, or given to calves, is divided by the butter made, and the quotient gives the ratio of milk to butter, a most important item to know. This account also affords information for charging milk used against calves and pigs.

Specimen page of Cow Herd-Book.

POLLY.

Purchased of Jno. Smith, Exeter, Jan. 6, 1882, aged 2 years 6 months; red and white.

Sire.—William I. by William, dam Caroline.

Dam.—Minnie (172) by John Bull, dam Vixen.

Minnie took 1st prize, Devon Show, 1878.

Served by Pilot, 762, Jan. 12, 1882.

Calved—hcifer calf—red, Oct. 10, 1882.

Served by Jack, Dec. 7, 1882.

Record, calving to drying, 6,132 lbs. milk.

Dried, July 5, 1883.

Calved—bull—red and white, Sept. 5, 1883.

Specimen of Pig Herd-Book and Record.

Duchess (Black Berkshire).

Bred by myself; Sire, Duke; dam, Short-nose. Farrowed, Oct. 6, 1882. The best sow in the litter of 11.

Date of Service.	Sire.	Date of Farrowing.	No. in Litter.	Boars.	Sows.	Dead.	Days of Gestation.
1884		1885					
Dec 22	Emperor	April 11	8	6	2	—	110

Cultivation Record.

Every arable field should be represented in a book each year, by a plan showing exactly what treatment it has received and what it has yielded.

1886.—*Church Field.*—18 *acres.*

Winter Fallow.
Ploughed 14th May to 16th May.
Drag-harrowed, May 17th, 19th, 20th.
Fine-harrowed, 21st, 22nd, 24th.
Successions of weeds killed.
Manured 12 tons per acre.
Ridged, May 26th.
Ridges split, 28th, 29th.
Drilled, 29th, 30th, 4 lbs. Sutton's hybrids per acre.
Plants set out, July 14th.
Horse-hoed, July 26th
Do. Aug. 2nd.
Few patches of fly appeared, Aug. 6th, 8th. Parts dressed.
Crop lifted and clamped, Nov. 5th, 6th, 7th. About 16 tons per acre.
Ploughed, Nov. 17th, 18th, 19th.

A record of this kind, amplified with notes upon the weather, and any other practical data, is of the highest importance in suggesting in future how crops may be improved, mistakes avoided, or old returns sustained.

INDEX.

A.

Albumen in Milk, 5.
Alsike, 97.
Ayrshire Cows, 42.

B.

Barn Gallon, 16.
Berkshire Pigs, 60.
Blending Butter, 33.
Brining Butter, 22.
Broad Red Clover, 96.
Bulls, 49.
Butter Blending, 33.
,, Brining, 22.
,, Colouring, 24.
,, Dairy, 20.
,, Grains, 22.
,, Making Account, 108.
,, ,, Plant, 20.
,, Milk, 6.
,, Packing, 23.
,, Salting, 22.
,, Worker, 21.

C.

Cabbage, 72.
Cake, Cotton, 75.
Calf Breeding, 50.
,, Pens, 49.
,, Rearing, 51.
Calving, 49.
Camembert Cheese, 29.
Casein, 5.
Catchwork System, 102.
Cheddar Cheese, 29.
Cheese, Camembert, 29.
,, Cheddar, 29.
,, Gervais, 15.
,, Gorgonzola, 29.
,, Pommel, 15.
,, Soft, 28.
Cheshire Cheese, 66.
Churns, Railway, 17.
Churning, 12, 21.
Clotted Cream, 13.
Clovers, Principal, 96.
Clover Ley Mixture, 72.
Cocksfoot Grass, 95.
Colostrum, 6.
Colouring Butter, 24.
Composition of Milk, 1.
,, ,, Hay, 78.
Cooley System, 11.
Cotton Cake, 75.
Cow Calving, 50.
Cow Herd-Book, 109.
Cow House, 46.
Cows, Cropping for, 70.
Creamer, Jersey, 20.
Cream Yield, 14.
Crested Dogstail, 94.

Cropping for Cows, 70.
Crops, Rotation of, 73.
Cultivation Record, 111.
Curd Cheese, 28.
,, in Cheese-making, 27.
,, Mills, 28.

D.

Dairy, The Butter, 20.
Delaiteuse, 21.
Devons, 41.
Devonshire System, 11.
Diaphragm Churn, 21.
Dry Food. 97.

E.

End-over-End Churn, 21.
Expenditure Account, 106.

F.

Fat in Milk, 3.
Fermentation of Manure, 86.
Fescue, Hard, 94.
,, Meadow, 93.
,, Tall, 94.
Fiorin, 94.
Food, Function of, 57.
Foxtail, 94.

G.

Gallon, Barn, 16.
Gervais Cheese, 15.
Gorgonzola Cheese, 29.
Grains, Butter, 22.
Grasses, Description of Principal, 93.
Grass for Silage, 37.
,, Seeds, 92.
,, ,, Testing, 92.
Green Crops for Cows, 57, 70.
Guernsey Cow, 44.

H.

Heat-giving Foods, 56.
Heavy land, 74.
Holstein Churn, 21.

I.

Injurious Organisms, 7.
Irrigation, Value of, 102.
,, Italian, 101.
Italian Rye Grass, 96.

J.

Jersey Cows, 44.
Jersey Creamer, 14.

K.

Kerry Cow, 42.

L.

Labour, 67.
Liquid Manure, 86.
Lucerne, 65, 72, 73.

M.

Manure, Liquid, 86.
,, Fermentation of, 86.
,, Money Value of, 87.
Marchand's Test Tube, 4.
Meadow and Pasture, 78.
Medium land, 74.
Milk Account, 107.
,, Churning, 12.
,, Fat, 3.
,, its Composition, 1.
,, Skim, 33.
,, Solids, 2, 5.
,, Standard, 17.
,, Weighing, 69.
Money Value of Manure, 87.

N.

Nitrogenous Foods, 56.

O.

Organisms, Injurious, 7.

P.

Perennial Red Clover, 97.
,, Rye Grass, 96.
Pig Herd-Book, 110.
,, Styes, 62.
Pommel Cheese, 15.
Poor land, 74.
Potatoes, 73.

R.

Railway Churns, 17.
Rations, Cows', 58.
,, Pigs', 63.
,, Winter, 48.
Red Polls, 44.
Rotation of Crops, 73.
Rough-stalked Meadow Grass, 95.

S.

Salting Butter, 22.
Separators, 12.
Shallow Setting, 10.
Short-horns, 39.
Silos, 37.
Skim Milk, 33.
Soft Cheese, 28.
Solids of Milk, 2, 5.
Standard of Milk, 17.
Styes, Pigs', 62.
Sugar of Milk, 4.
Swartz System, 11, 20.
Sweet-scented Vernal Grass, 94.
System of Cultivation, 70.

T.

Tamworth Pigs, 60.
Test Tube, Marchand's, 4.
Testing Grass Seeds, 92.
Timothy Grass, 95.

W.

Water Meadow Grass, 95.
Weaning Calf, 51.
Weighing Milk, 69.
Weight of Milk, 6.
White Clover, 96.
Winter Rations, 48.

Y.

Yield, Cream, 14.

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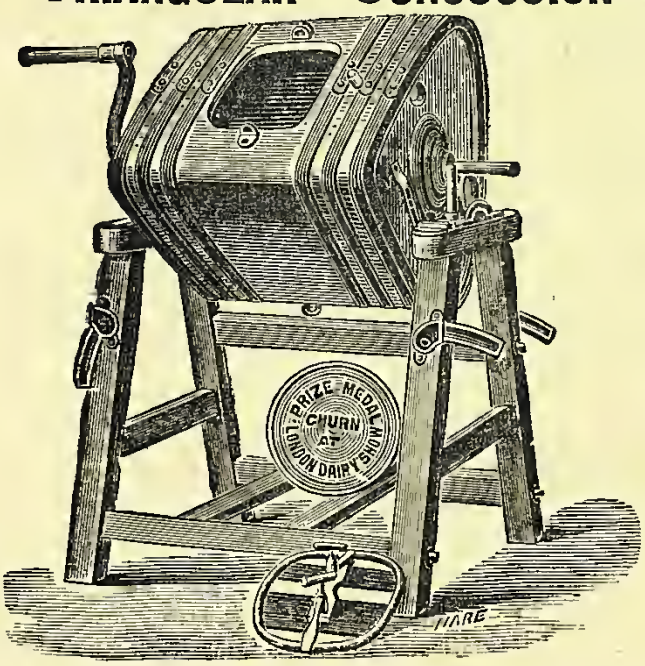

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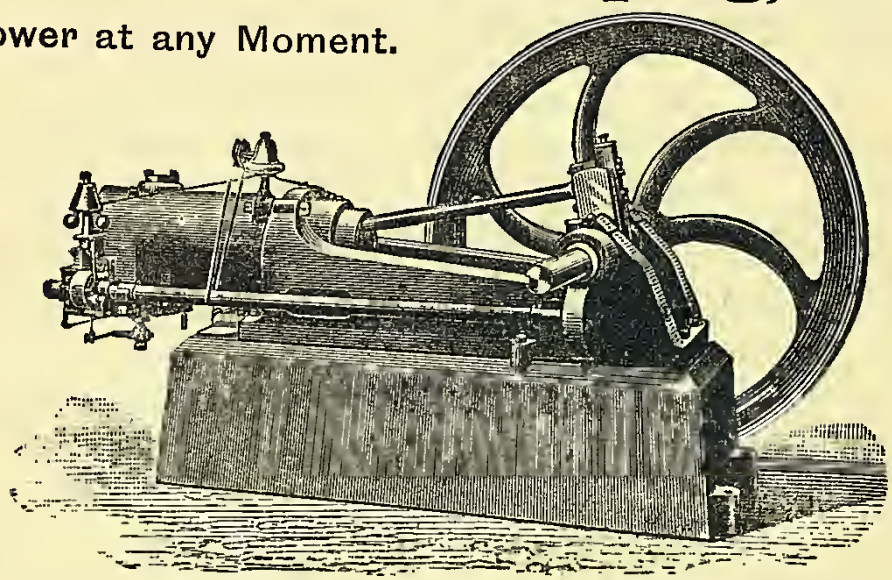

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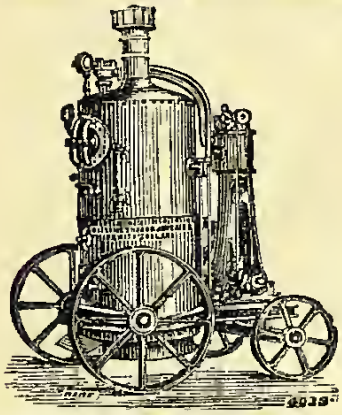

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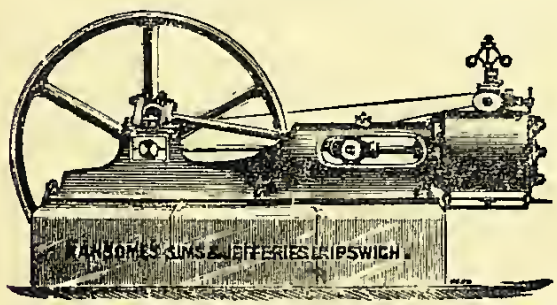

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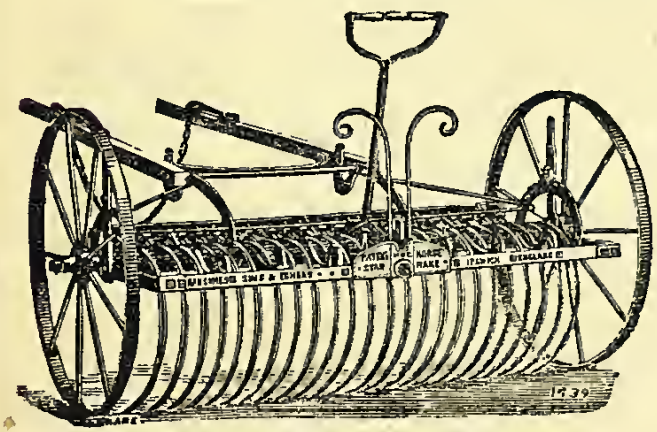

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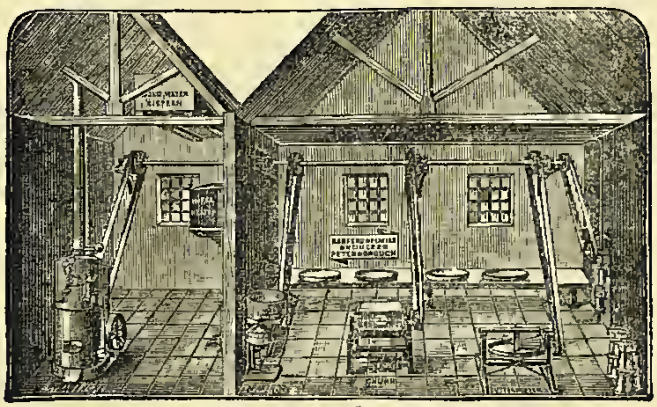

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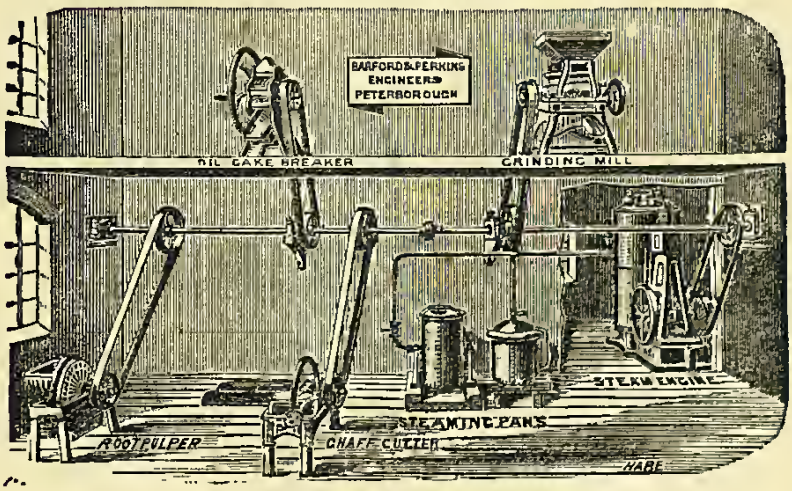

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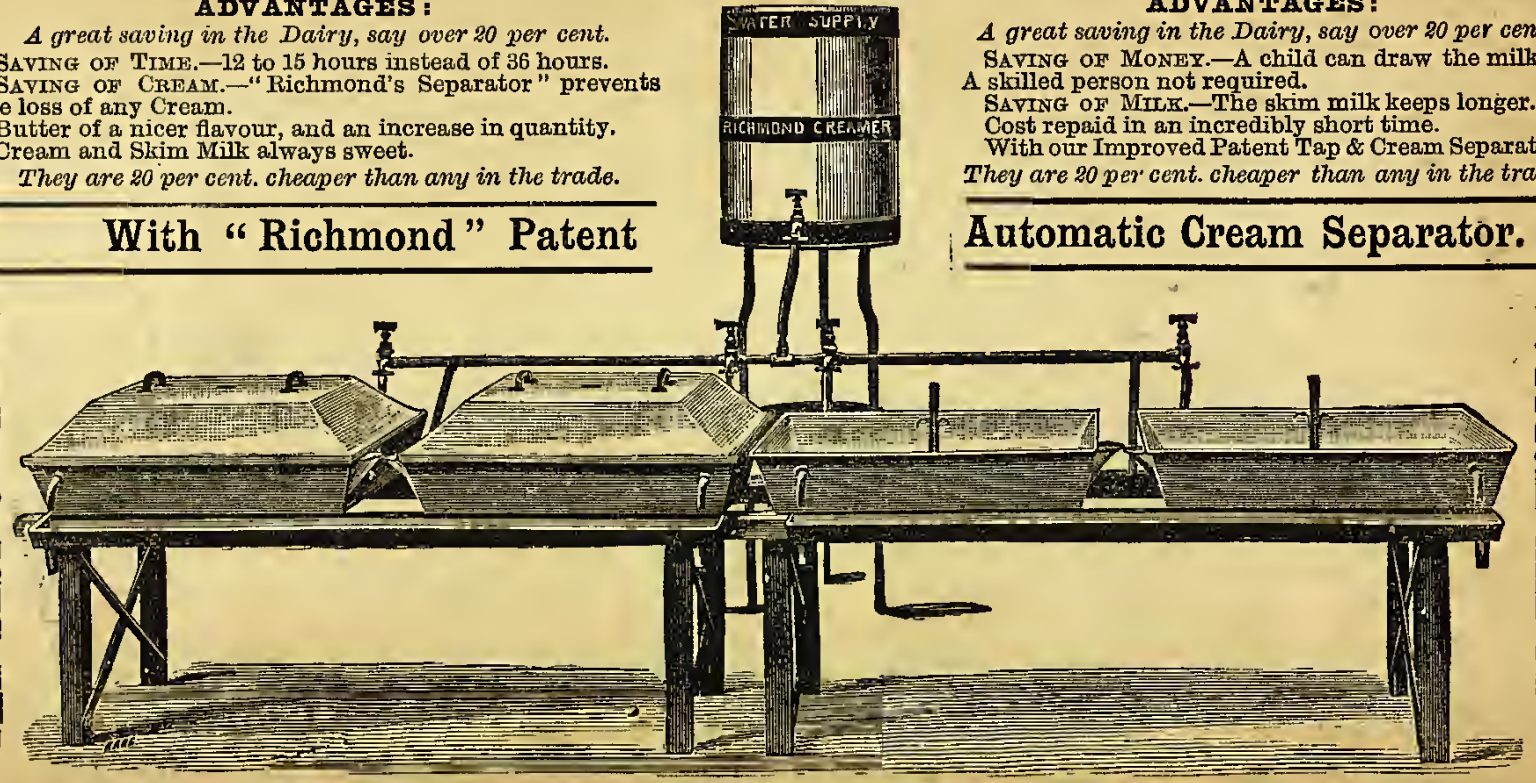

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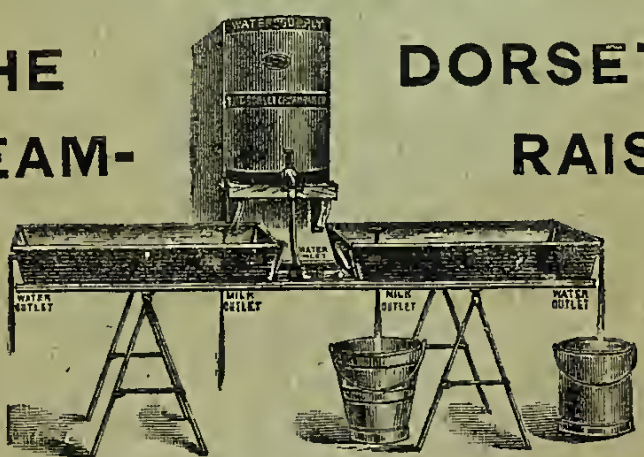

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